University of Glamorgan

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IT adoption in the Construction Sector in Libya

Mohamed A M Elkabeer Abdulhadi
BSc- Engineering, MSc –Project Management,
MSc - Marketing

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Declaration

This is to certify that, except where specific reference is made, the work described in this thesis is the result of the candidate. Neither this thesis, nor any part of it, has been presented, or is currently submitted, in candidature for any degree at any other University.

Signed ----------

Candidate Mohamed Elkabeer

Date: ----------

Signed ----------

Director of Studies: Dr Ramdane Djebarni

Date: ----------

Signed ----------

Supervisor: Dr Liang Jiang

Date: ----------

Dedication

All my gratitude, thanks and submission are to ALLAH who gave me everything. This work would not have to be completed without the invaluable assistance, help and encouragement of my wife Marwa for her passionate love and continuous support and also to my son Naseraddien for just being there, for their sleepless nights which have been so much more painful and stressful. Also I dedicate to my uncle Hassan Elkabeer and his family, my grandmother Fatma for their prayers and support and to my mother, father, lovely sisters, and my unique brothers who gave me life, and to all Elkabeer family, I also dedicated to my uncle Mohamed Abukhirais and his entire family, who will share my joy in reaching this goal and for their prayers and encouragement and support during the long and sometimes frustrating hours I spent to achieve the highest academic degree possible.

This work is also dedicated in the memory of my grandmother Fatma, and to my younger brother Abdulnaser, also to my cousin Ali Hassan Elkabeer whoes passed away while I'm on my study without witnessing their death, and Finally to the memory of the leader Muammer Al Gaddafi. May his soul rest in peace.

Abstract

The main aim of this research is to study the IT adoption in the Libyan construction industry. In order to achieve this aim, two methodologies (qualitative and quantitative methodologies) were used for this purpose. The interviews with 26 managers reveal that The Libyan construction industry faces many barriers such as the lack of a skilled workforce in the field of IT, lack of training, lack of internet security, lack of government regulations, weak banking systems, and problems with communications network.

Based on the literature and on the interviews an IT adoption model was designed and statistically tested. The model connected the dependent variable and 9 independent variables with 16 moderator variables. The dependent variable was the IT adoption, the independent variables were, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms. While the moderator variables were voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, business-level attitude toward IT adoption, number of employees, business type, time in business, type of organisation, availability of IT department, age of manager, degree, speaking foreign language and having IT budget. The model was tested using data collected by a survey from 260 managers in Libyan construction industry.

The results from the simple regression models which were derived between the IT adoption and each of the independent variables show that positive significant relationship between the dependent and all the independent variables.

A multiple regression was also carried out and found that result demonstrability, image, facilitating conditions and subjective norms are the most dominant variables in the model. Then the effect of the moderator variables on the derived model was tested using MODPROBE Marco developed by Hayes and Matthes (2009) and it is compatible with SPSS.

Interesting results were found from the statistical tests. From 16 moderator variables only five variables were found to have significant effect on the derived multiple regression model. These variables are: voluntariness, number of employees (i.e. size of the organisation), time in business (i.e. organisation age), type of organisation (i.e. public, private and foreign) and the manager age. These findings are also supported by the literature. These are explained in detail in chapter 7.

Acknowledgement

All my gratitude, thanks and submission are to ALLAH who gave me everything. My sincere gratitude goes to the director of study Dr Ramdane Djebarni who works with me tiredlessly during my study. His supervision, guidance, support and encouragement are highly appreciated for his professionalism, friendly and cordial relationship, creativity, exceptional statistical analysis expertise, general guidance and counsel through the course of this study. In addition, my thanks also go to my supervisor Dr Liang Jiang for his support and help.

I would like to thank my friends in Libya for their support and encouragements and also would like to thank all my friends/colleagues here in Glamorgan and Cardiff universities who encouraged me during my study.

I would like to thank the Libyan authorities for granting me a scholarship to pursue my postgraduate study in the United Kingdom**.**

I would like to thank those companies whom spent time in answering the pre-designed questionnaire and sent it back to me, and also to thank those managers who gave me time to carry out the interviews of this research.

I also wish to acknowledge all my members and friends who provided me with encouragement and love which influenced my success, I am truly thankful and blessed to have these caring people in my life.

I would like to thank many people who helped me during my study on this research.

Finally, I would like to thank everyone else who provided me with advice, support and assistance throughout my study.

Sincerely, I say, ‘Thanks to everyone!

List of abbreviations

a	= intercept
AG	= Age of manager
AO	= Achievement Orientation
b1, b2, b3	= constants
BA	= Business-level Attitude toward IT adoption
BI	= Behaviororal Intention to use
BIS	= Business Innovation and Skills
BT	= Business Type
CENTRIM	= Centre of Research in Innovation Management, Brighton University
CEO	= Chief Executive Officer
CO	= Compatibility
CPU	= Central Processing Unit
CRM	= Customer Relationship Management
CS	= Company Slack
DE	=Degree
DoI	= Diffusion of Innovation
DTI	= Department of Trade and Industry
DTM	= Diffusion Technology Model
EAI	= Enterprise Application Integration
ED	= Environmental Dynamism
EDI	= Electronic Data Interchange
EO	= External Orientation
EPS	= Earning Per Share
ERP	= Enterprise Resource Planning
EU	= Ease of Use
F	= is the focal variable
FC	= Facilitating Conditions
FL	= Foreign Language
GE	= Gender
GII	= Global Innovation Index
HCI	= Human-Computer Interaction

IB = IT Budget
ICT = Information and Communication Technology
ID = IT department
IDI = Individualism Index
IDT = Innovation Diffusion Theory
IM = Image
ISP = Internet Service Provider
IT = Information Technology
ITU = International Telecommunication Union
JIT = Just In time
k = number of predictor variables
KMO = Kaiser-Meyer-Olkin (statistical test)
LAN = Local Authority Network
LTO = Long-Term Orientation
M & Z = moderator variables
MAS = Masculinity Index
NE = Number of Employees
OECD = Organisation for Economic Co-operation Development
PDI = Power Distance Index
PEOU = Perceived Ease of Use
PR = Pro-activity
PU = Perceived Usefulness
QC = Quality Control
QR = Quick Response
R&D = Research and development
RA = Relative advantage
RD = Result Demonstrability
RDT = Resources Dependence Theory
ROA = Return On Assets
ROE = Return On Equity
ROI = Return On Investment
RPM = Rapid Prototype and Manufacturing
SBE = Small Business Enterprises
SME = Small Medium Enterprises

SN = Subjective Norms
TAM = Technology Acceptance Model
TB = Time in Business
TC = Type of Company
TMT = Technology, Media and Telecommunications
TQM = Total Quality Management
TR = Trialability
UAI = Uncertainty Avoidance Index
UTAUT = Unified Theory of Acceptance and Use of Technology
VI = Visibility
VO = Voluntariness
W = is one or more additional predictor variables that added to the model
Y = is the estimate of the outcome variable

AUTOCAD; ETAB; STADD; ORIENT; STUDS and STRUDS= Engineering software.

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Chapter One: General Introduction

1.1 Introduction

This chapter comprises of the following main headings: background related to the importance of the innovation to the Libyan construction organisations, ICT in Libya, importance of this research and its contribution to the state of knowledge, aim and objectives of this research, the conceptual model of this research, research hypotheses, structure of the thesis and conclusions.

1.2 Background

Innovation is central to the growth and development of human organizations whether small or large, commercial or non-commercial and plays an important part as a stimulant to competition which provides the driving force of enterprise. For example O 'Regan, et al (2006), Becheikh, et al (2006), Bala Subrahmanya, et al (2009, 2010) and Tan et al (2011) indicated that innovation is important to an organisation since it strengthening the firm's competitiveness and growth. In their discussion to the innovation and the importance of the Information and Communication Technology (ICT), Tan et al (2011, p. 1) stated that '*Information and Communications Technology (ICT) has been widely regarded as an enabler to boost the competitive level of SMEs in the business arena'.* A systematic approach, therefore to the creation of an environment in which innovation can be fostered together with an analysis of those factors which might encourage or impede innovation is essential in any study of projects where radical changes are not only desirable but imperative for economic growth.

Aubert (2004: 6) discussed the innovation in developing countries and stated:

"It should be clear that the concept of "innovation" encompasses not only "technological innovation", i.e. the diffusion of new products and services of a technological nature into the economy, but equally it includes non-technological forms of innovation, such as "organization" innovations. The latter include the introduction of new management or marketing techniques, the adoption of new supply or logistic arrangements, and improved approaches to internal and external communications and positioning. Although this paper will argue for an embedment of technology promotion within broader actions aiming at upgrading enterprises, industries or regions, it will focus on technological innovation."

The perceived benefits of the adoption and diffusion (AD) of ICT to the construction industry have been acknowledged by many researchers such as Oladapo (2007), Yeomans (2005), IT construction (2004), Mui et al (2002), Sarshar et al (2002), Wilkinson et al (2002. However,

the adoption and diffusion of ICT systems in an organisation is not an easy task (Hill et al 1998). This is related to the fact that there are many factors e.g. managerial, financial, training, and cultural, which have direct and indirect impacts on the adoption and diffusion of ICT systems in organisations. This will be explained in more detail in the literature review (chapter 2). Despite many researches have been carried out in the field of adoption and diffusion of ICT, and many theories and models related were presented, but unfortunately the literature shows there is no theory or model can claim its unlikeness in interpreting the adoption and diffusion on international scale. This is related to the fact that so many variables affect the process of adoption and diffusion of the ICT in SMEs. Some of these variables are related to the management/employees attitudes toward the ICT, characteristics of the technology, government policies and support and cultural variables. For example Afzal (2008), Oak (2007), McCoy et al (2005), Elbeltagi (2007) and Mostaf (2005) highlighted the importance of the cultural factor in adoption and diffusion of the ICT. This justifies the need to conduct a research related to the adoption and diffusion of ICT systems in Libyan SMES.

Libya is a developing African country with a population of approximately 5.7 millions and a very vast area of approximately 1,759,540 million sq. km (90% of it is desert area), slightly larger than Alaska and US. The capital city is Tarabulus (Tripoli). It shares borders with Algeria 982 km, Chad 1,055 km, Egypt 1,115 km, Niger 354 km, Sudan 383 km, and Tunisia 459 km. Life expectancy is around 76 years. Birth rate is on average 3.3 per woman. Literacy rate is just over 82%. The main language is Arabic and the Italian and English are widely understood in major Libyan cities. The population comprises of Arab and Berber (97%) of the population and the 3% comprises of Greeks, Maltese, Italian, Egyptians, Pakistanis, Turks, Indians, and Tunisian. From the religion viewpoint, the Sunni Muslims make up 97% of the population. The location of Libya in Africa is shown in Figure. (1-1) below.

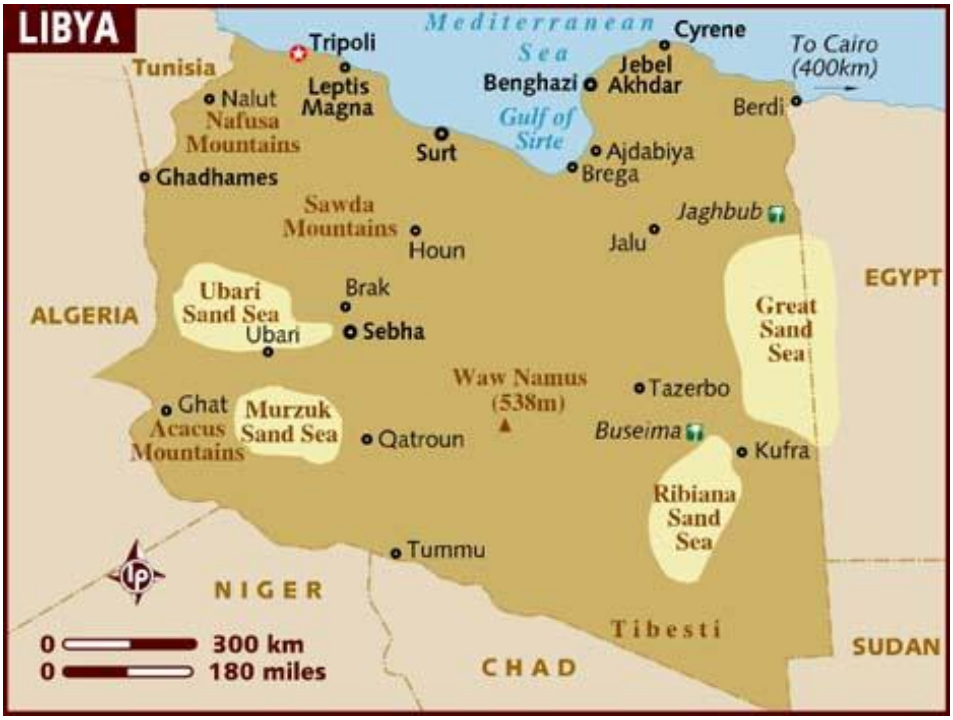


Fig.(1-1): The geographical location of Libyan- in Africa, Lonely Planet (2012)

1.3 ICT in Libya

Global Innovation Index (GII) report published by the business school INSEAD and Confederation of Indian Industry (2009), shows the countries around the world with their (GII) and international rank in Table (1-1) below.

Table (1-1): Innovation indices for selected countries, INSEAD (2009)

Country	index	Rank
United states of America	5.28	1
Germany	4.99	2
Sweden	4.84	3
United kingdom	4.82	4
Qatar	4.12	24
United Arab emirates	3.99	26
Saudi Arabia	3.65	32
India	3.44	41
Oman	3.23	52
Jordan	3.16	55
Egypt	2.83	76
Morocco	2.76	82
Algeria	2.29	108
Libya	2.13	118
Lesotho	1.93	128
Timor-Leste	1.89	129
Burundi	1.18	130

The Global Innovation Index (GII) calculations in Table (1-1) above relied on five input categories: *institutions and policies*, *Humana capacity*, *infrastructure*, *market sophistication, and business sophistication*. The output is: *knowledge*, *competitiveness*, and *wealth*. Table (1-1) shows that the rank of Libya is 118 of 130 countries assessed for their innovation index. It also shows that Libya index of innovation is 2.13 of 7, which is very low compared with other countries.

It has been pointed by en.wikibooks (2010b) that most SMEs in developing countries cater to local markets and therefore rely heavily on local content and information. For this reason, there is a need to substantially increase the amount and quality of local content (including local language content) on the Internet to make it useful especially to low-income entrepreneurs. Moreover, en.wikibooks (2010b) highlighted five ways by which the internet and e-commerce are useful for developing entrepreneurs as follows:

1. It facilitates the access of SMEs to world markets.
2. It facilitates the promotion and development of tourism of developing countries in a global scale.
3. It facilitates the marketing of agricultural and tropical products in the global market.
4. It provides avenues for firms in poorer countries to enter into B2B and B2G supply chains.
5. It assists service-providing enterprises in developing countries by allowing them to operate more efficiently and directly provide specific services to customers globally.

The Arab Human Development Report (2003) related to the building a knowledge society indicated that despite the availability of significant human capital in the Arab world, the disabling constraints obstruct the acquisition, adoption and diffusion of the technologies in the Arab world region.

Young Arab leaders FORUM (2007) which was held in Bahrain in 2007 stressed on the importance of the innovation to the Arab world. The Arab young leaders stated:
"*Knowledge production is the key to innovation. Whether the measurement indicator is scientific papers published per million people, number of patents issued, the proportion of full-time scientific researchers or venture capital investments as a percentage of gross*

domestic product (GDP), the Arab world has (until recently) placed behind other nations, both developing and developed countries."

It seems from the above information that the Arab world and especially Libya is behind the world in level of ICT utilisation.

The main barriers to the ICT adoption in Libya have been highlighted by Hamdy (2007), Rhema & Miliszewska (2010), and Hamed (2009). For example Hamed (2009) highlighted the following points which should be considered by the Libyan government to promote the e-commerce adoption in the country:

- Legislation and Regulation,
- Telecommunications infrastructure,
- Postal Infrastructure, International Trade,
- Establishing E-commerce Department,
- Payment System,
- Removing Barriers to Foreign Investment,
- E-government Strategies,
- Low Cost Hardware and Software,
- Education and Labour Training, Lowering Taxation, Culture, and Religion and Values.

While Hamdy (2007) and Rhema and Miliszewska (2010) highlighted the lack of skilled ICT teachers in schools, e-learning, and the weakness of the existing ICT infrastructure.

From studies carried out by Hamed (2009), Hunaiti et al (2009), Hamdy (2007) and Rhema and Miliszewska (2010) on the ICT adoption in Libya, the following main barriers can be recognised:

The current situation of the ICT system in Libya is underdeveloped. This point has been highlighted by Rhema and Miliszewska (2010), Hamed (2009), and Hamdy (2007). However, Rhema and Miliszewska (2010) indicated that in 2008 there was plan adopted by the Libyan government to develop the ICT infrastructure.

Nevertheless, Hamdy (2007) and Rhema and Miliszewska (2010) studied the utilisation of the ICT in higher education in Libya and highlighted the point that Libya is lagging behind the other countries in its adoption to the ICT in higher education.

The main barriers which face the Libyan organisations that were highlighted by many researcher such as Rhema and Miliszewska (2010), Hamed (2009), and Hamdy (2007).. The main barriers are summarised below:

- Internet security
- Lack of knowledge about technology
- Lack of skilled people
- Lack of education and training courses
- Postal addresses barriers
- Lack of public awareness
- Weak banking system
- Lack of government regulations
- No government support for the private sector
- Low foreign investment

Alrawabdeh (2009) discussed the internet in the Arab world and indicated that the main challenges facing the Arab world are related to a number of social, technological, financial and legal issues. He added that the major part of barriers challenging adoption and usage of the Internet lies in the political and regulatory environment, individual awareness and access to new technology in the business and governmental sectors. Nevertheless, he believes that the internet barriers in Arab world lie within the points which are summarised below:

- The inability of the Arab world government to consider the internet technology adoption as one of its priorities.
- Inability of the Arab world countries to dedicate an important portion of their budgets to support and build up the ICT infrastructure and to encourage people to use the internet services widely.
- Absence of mutual strategic cooperation between the Arab countries on the issue of developing and encouraging people to use it between the Arab countries, and also lack of cooperation between academic institutions and organisations in the same country.

- Except the Gulf States, most Arab countries found it difficult to pay their contribution covering internet connection fees. This is an important factor that prevents people to subscribe to the internet service. For example, the free internet strategy which has been followed by Egypt resulted in that Egypt has the highest number of internet users in Africa, Paul (2006).
- Minister of education and higher education in Arab countries pay less attention to the tainting programs for teachers on how to use the internet. This has a negative impact on the younger generations of students.
- Language is one the most important barrier face the Arab citizens. This point is also highlighted by Global Reach (2004). From the 300 millions Arab citizens only 1.4% of the population uses the internet.
- The absence of effective governmental laws and legislations to explain how to use the internet within an individual country or among the Arab countries.
- Insufficient rewards given to an individual or organisations that show interest in providing internet technology services.
- Absence of the role of the private sector in filling the gaps in this new technology
- User 'acceptance' is important for every society to enhance and promote the use of the internet technology.

1.4 Importance of this research and its contribution to the state of knowledge

The reasons, which have led the researcher to carry out this research, are:

Initial investigations indicate that the Libyan construction organisations currently have limited awareness of the potential of ICT systems to increase their operational efficiency. Studies such as Monitor group (2006) and Grifa (2006) have indicated that there are many challenges that face the Libyan organisations. For example in construction industry they highlighted that these challenges are related to the lack of a skilled workforce, equipment, a difficult regulatory environment related to the construction industry and finally companies do not have the access to capital and lack basic supplies of steel and cement.

Grifa (2006) has also indicated that there are other challenges to the Libyan construction sector and these are related to the current Libyan organisation and structures which are reliant on the state for their channels of finance and display a weakness of communication and information systems. As far as the information and communication technologies are

concerned, Grifa (2006) has pointed out that there is a lack of knowledge in this important field and therefore attention should be focused on this field and its important role in the construction industry. He stated that:

"*Owing to the low capacity and capability of consultancy and construction firms, relying on local construction industry in terms of planning, design, production and construction services, it is unlikely to be sufficient for some time yet".*

Very limited literature related to the Libyan work in construction organisations has been published. World Bank (1988) and Grifa (2006) have indicated that the construction industry has been given little attention compared to other economical sectors such as the manufacturing and agricultural sectors. However, Grifa (2006) has carried out research related to the construction operations in Tripoli (Libya) and indicated that the Libyan construction industry is under-researched. Grifa pointed out that the construction industry topic is not attractive to researchers and especially to Libyan students. He concluded after reviewing the Master and Doctorate studies which have been carried out in the United Kingdom's universities in the past two decades that no study was found to be related to the construction industry as a whole or complementary sectors. This is a very important point in supporting and justifying the compilation of this study. This means that carrying out this study will provide the construction industry with useful information, which could help in understanding the Adoption and Diffusion of the Advanced Technologies in the construction industry. As a result this may help in expanding the construction management profession and this is a positive contribution towards the state of knowledge.

It can be concluded from the above explanations that the SMEs in construction enterprises in Libyan lacks the experience and knowledge in the utilisation of the Information and Communication Technologies (ICT) in their processes and operations. This justifies a study to be carried out in this area to ascertain the strengths and weaknesses of ICT utilization in the Libyan construction industry. By understanding this it becomes possible to recommend a model on how to develop the current practice and operations of the Libyan construction industry.

The existing models and theories have been developed for different cultures and since it has been highlighted by Rogers (1993, 1995), Roger (1995) and Hill et al (1998) that the Diffusion and Adoption of the ICT systems depends on cultural factors, the investigation of

the impact of Libyan cultural factors on the Adoption and Diffusion of the ICT in Libyan construction organisations will be a very useful contribution to the expansion of the state of knowledge in African and Arab countries.

Twati (2006) studied the impact of societal and organisational culture on adoption of Management Information Systems (MIS) in Arab Gulf States countries (Kuwait, Oman, Saudi Arabia and United Arab Emirates) and North African countries represented by Libya. In his selection to Libya Twati (2006) stated that:

"Libya was chosen as a representative of the North African region because Libya has not covered in MIS literature to date. In addition, although Libya is one of the wealthiest countries in North Africa, it has not yet widely adopted MIS"

The above statement highlights the fact that adoption of the information systems in Libyan organisation is not well researched. Therefore, a study is needed to go in depth to investigate factors affect the adoption of the technological systems in Libyan organisations.

Twati (2006) also highlighted that the organisations in North African countries (including Libya) are dominated by a hierarchical culture that favours centralised management system. He pointed that the centralisation of power in organisations has a negative impact on the adoption of the Management Information Systems (MIS). It is interesting to investigate this issue of preference in Libyan SMEs.

Hunaiti et al (2009) in their discussion of the e-commerce in developing countries with a special reference to the case of Libya, indicated that the main challenges facing the e-commerce in Libya are the expensiveness of the internet pricing, unsuitability of online shopping services and Libya postal system; and the Libyans' culture and their limited trust in the online trading systems.

Interesting information related to the Innovation for countries around the world has been presented by Global Innovation Index (GII) report published by the business school INSEAD and Confederation of Indian Industry report (2009) as shown in Table (1-1) mentioned earlier. The report gave Libya 2.13 on scale of 7 and ranked Libya 118 out of 130 countries included in the report.

It can be concluded that the adoption and diffusion of the ICT in Libyan construction organisations is not well investigated. The researcher believes that this study will throw the light on the current situation on the ICT system and also highlight the main obstacles which are facing the adoption and diffusion processes in Libyan construction industry. The findings of this study will be very useful for policy makers and to many parties in the supply chain who deal with SMEs.

1.5 The aim and objectives of this research

The main aim of this research was to investigate the IT adoption in Libyan construction sector. Two methodologies (quantitative and qualitative methodologies) were devised to investigate this important issue. In order to achieve this mentioned aim, four objectives were set.

The first objective was set to review, analyse and synthesise the current available literature (theories and models) related to the IT adoption and innovation in this field.

The second objective was set to build up a conceptual model for this research to explore the relationship between the constructs of the model

The third objective was set to devise two methodologies (quantitative and qualitative methodologies) to explore the following issues:

- To investigate the profiles of the Libyan construction organisations and also the profiles of the managers/engineers who run these organisations
- To investigate the internal barriers face the Libyan construction organisations in their utilisation of the IT in their daily activities
- To investigate the external barriers face the Libyan construction organisations in their utilisation of the IT in their daily activities.
- To investigate the relationships between IT adoption and IT innovation factors such as relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms.

- To explore the effect of innovation moderator variables such as (voluntariness, external orientation, achievement orientation, company slack, pro-activity, external dynamism, business-level attitude towards IT adoption) on IT adoption.
- To explore the effect of organisation moderator variables such as (organisation size - number of employees, type of business, time in business, Type of company, availability of IT department and having an IT budget) on IT adoption
- To explore the effect of managers moderator variables such as (age of manager, degree, and ability of speaking foreign language) on IT adoption

The fourth objective was set to draw useful conclusions to benefits the Libyan construction organisations

In order to achieve the above mentioned aim and objectives the researcher has used qualitative approach (semi-structured interviews with 26 managers who work in Libyan construction industry) and also quantitative approach (questionnaire approach – 400 questionnaire and only 260 forms have been completed by the managers).

1.6 Conceptual model of this research

The conceptual model is shown in Figure (1-2) below. The conceptual model of this research consists of three types of variables: dependent variable (IT adoption) , independent variables (relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, and subjective norms) moderator variables (voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, business level attitude toward IT adoption, manager age, gender degree, speaking foreign language, IT budget, number of employees, type of business, time in business, type of organisation, IT department). These variables based on the literature review.

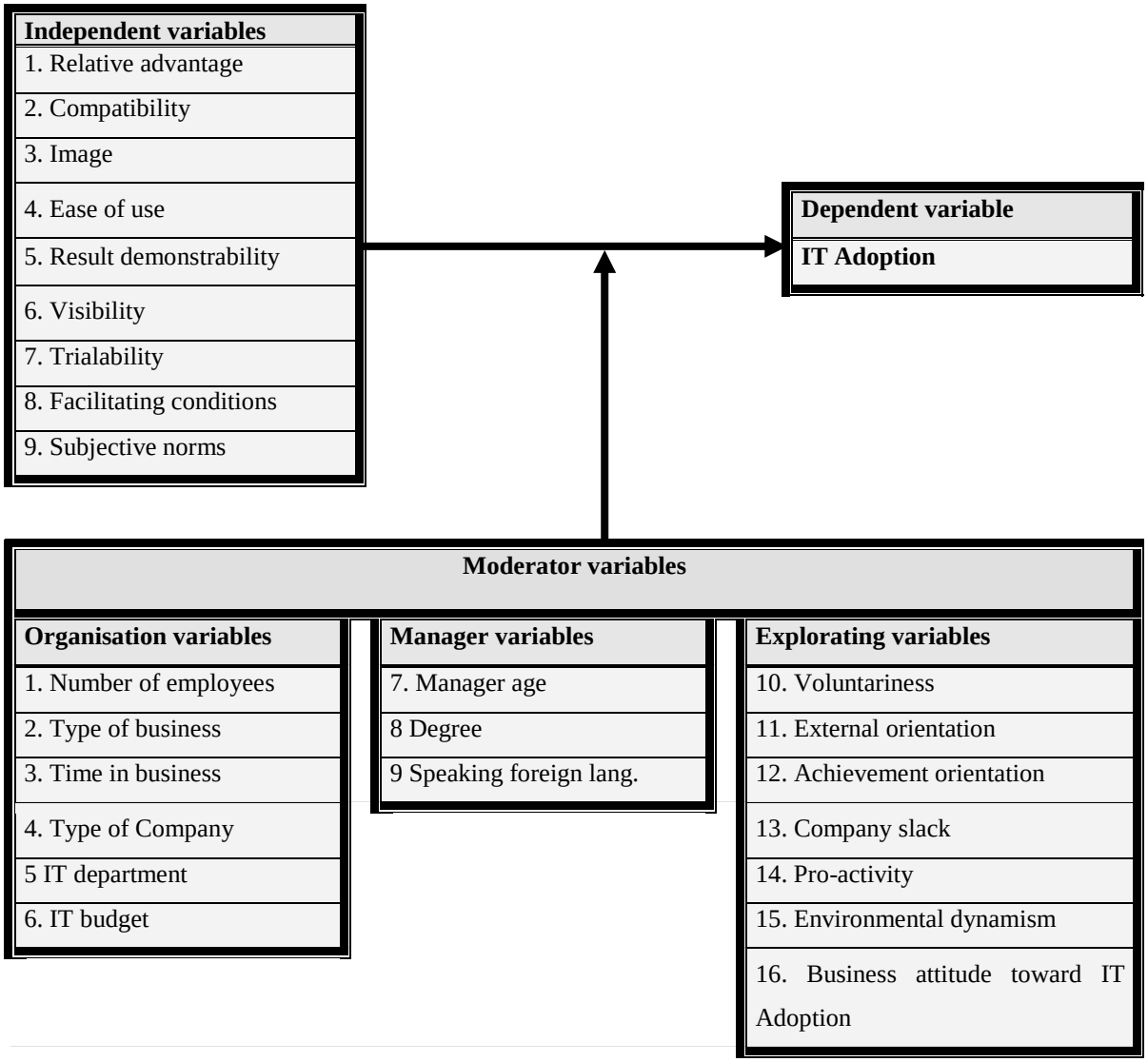


Figure (1-2): Conceptual model for this research

1.7 Research Hypotheses

Hypothesises which were used in this research are shown below.

These hypotheses are related to the adoption and independent variables such as: relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms.

Hypotheses of independent variables

H_1: There is a positive relationship between the adoption and the relative advantage of the IT system

H_2: There is a positive relationship between the adoption and the compatibility of IT system

H_3: There is a positive relationship between the adoption and the image of the organisation resulted from the adoption

H_4: There is a positive relationship between the adoption and the Ease of use

H_5: These is adoptive relationship between the IT adoption and the Result Demonstrability

H_6: There is a positive relationship between adoption and the visibility

H_7: There is a positive relationship between adoption and Trialability

H_8: There is a positive relationship between adoption and Facilitating conditions

H_9: There is a positive relationship between adoption and subjective norms.

Hypotheses of moderator variables

Hypotheses related to the impact of the moderator variables on the adoption derived general model. As shown in the conceptual model in Figure (1-2) that three types of moderator variables were used in this research. The hypotheses for these moderator variables are shown below:

Exploring moderator variables

H_{10}: The voluntariness factor moderates the relationship between the adoption and independent variables in their derived general model

H_{11}: The external orientation factor moderates the relationship between the adoption and independent variables in their derived general model

H_{12}: The achievement orientation factor moderates the relationship between the adoption and independent variables in their derived general model

H_{13}: The company slack factor moderates the relationship between the adoption and independent variables in their derived general model

H_{14}: The pro-activity factor moderates the relationship between the adoption and independent variables in their derived general model

H15: The environmental dynamism factor moderates the relationship between the adoption and independent variables in their derived general model

H_{16}: The business-level attitude toward IT adoption factor moderates the relationship between the adoption and independent variables in their derived general model

These hypothesise are related to the organisation and managers profiles as moderating variables.

Organisation moderators

H_{17}: Number of employees moderates the relationship between the adoption and independent variables in their derived general model

H_{18}: Type of business moderates the relationship between the adoption and independent variables in their derived general model

H_{19}: Time in business moderates the relationship between the adoption and independent variables in their derived general model

H_{20}: Type of company moderates the relationship between the adoption and independent variables in their derived general model

H_{21}: Having an IT department moderates the relationship between the adoption and independent variables in their derived general model

H_{22}: Having a specific IT budget moderates the relationship between the adoption and independent variables in their derived general model

Manager moderators

H_{23}: Age of manager moderates the relationship between the adoption and independent variables in their derived general model

H_{24}: Degree moderates the relationship between the adoption and independent variables in their derived general model

H_{25}: Speaking of foreign language moderates the relationship between the adoption and independent variables in their derived general model

1.8 Structure of the thesis

This comprises of eight chapters as shown in figure (1-3) below.

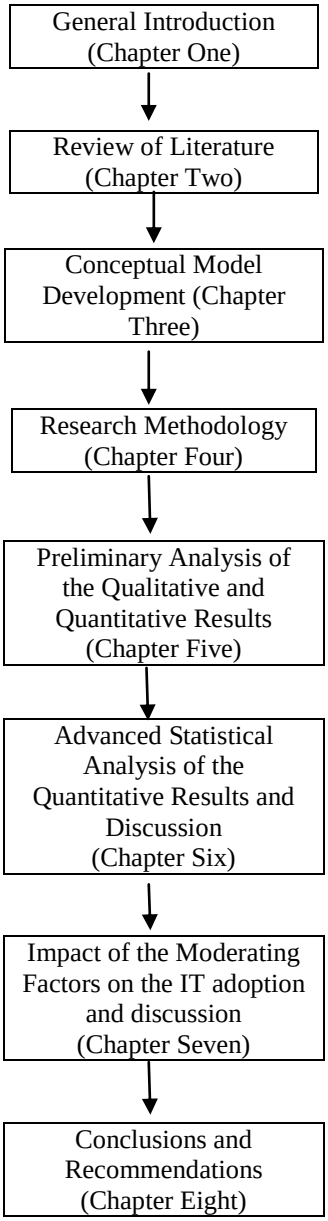


Figure (1-3): Structure of the thesis

a: Chapter 1: General introduction

This chapter includes general background to the subject, ICT in Libya, importance of this research and its contribution to the state of knowledge, conceptual model of this research, research hypothesis and thesis structure and summary.

b: Chapter 2: Literature review

This chapter includes the following main headings: introduction, definition of the innovation, innovation adoption review, Innovation Diffusion Theory (IDT), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Diffusion Technology Model (DTM), CENTRIM model, integrative innovation model, Leith's model, e-readiness model, absorption capacity, organisational learning, evolutionary perspective, push-pull theory, tri-core model, network externality, institutional theory, power perspective, Resources Dependence Theory, (RDT), other models. Use/benefits and drivers of using ICT, barriers to innovation, internal barriers, characteristics of the technology, complexity and difficulty of using the system, compatibility of the technology, security of the information, high cost of the system, innovation cost difficult to control, technical societal and inter-organisational barriers. Managerial characteristics, resistance of manager/owner to change, lack of education of manager/owner, lack of commitment of managers toward their organisations, style of manager, gender issue, age of manager/owner, lack of motivation and incentive schemes, lack of finance, lack of information about technology. Employees' characteristics lack of skills and experience, employee attitudes toward innovation, cultural factors. Organisation characteristics, organisation size, organisation age, and type of business. External barriers, lack of government regulations, lack of government/external financial support, unpredicted macro economy, lack of national /international standards, lack of national ICT strategy, tax regime, lack of students studying engineering sciences, lack of intellectual property rights, lack of cooperation with business partners, brain drain, and summary of the barriers. Proposed ICT adoption model framework for this research and conclusions.

c. Chapter3: Conceptual Model Development

This chapter has explained and discussed the development of the conceptual model of this research. The main points which have been covered in the chapter are: the constructs of the IT model, the dependent variable: IT adoption; the independent variables such as, the relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability,

facilitating conditions, and subjective norms. The chapter also covered the moderator variables such as voluntariness, external orientation, achievement orientation, company slack, pro-activity, environment dynamism, business attitude toward IT adoption, manager age, degree, speaking foreign language, number of employees, type of business, time in business, type of company, having an IT department, and having an IT budget. It has also included conclusions at the end of this chapter.

d: Chapter4: Methodologies of this research

This chapter is related to the methodologies (qualitative- interviews & quantitative – questionnaire). It includes: introduction, importance of doing research, research philosophy, research approaches, deductive approach, and inductive approach. The questionnaire strategy, some advantages of questionnaires, some disadvantages of questionnaire, pilot study, interviews strategy, structured interviews, semi-structured interviews, unstructured interviews and informal interviews. Selected strategies for this research, interviews methodology used in this research, development of interviews questions, carrying out the interviews and difficulties faced the researcher while doing the interviews. Questionnaire methodology used in this research, development of the questionnaire strategy of this research, sampling and sample size and conclusions.

e. Chapter 5: Preliminary Analysis of the Qualitative and Quantitative Results

This chapter has dealt with the preliminarily analysis of the obtained data from both the qualitative (interviews) and from the quantitative (questionnaire) methodologies. It has included the analysis of the qualitative data (interviews with 26 managers) and the analysis of the descriptive statistics of the quantitative data (questionnaire data obtained from 260 organisations). The main points which were included in this chapter from the interviews methodology were: profiles of the interviewed managers, questions used in the interviews, analysis of the interviews outcomes such as the types of software/hardware/activities, internal barriers face the organisations, external barriers face the organisations, organisations' requirements, suggestions for further development and issues not covered by the questions and highlighted by the interviewed managers.

The chapter also included the descriptive analysis of the results obtained from the questionnaire methodology. The main points which have been covered here are: the profile of the surveyed organisations and the profile of the managers, descriptive analysis to the dependent and moderating variables considered in this research conceptual model.

f. Chapter 6: Advanced Statistical Analysis of the Quantitative Results and their discussions

This chapter has dealt with the data analysis of the independent and dependent variables specified in this study. It has covered IT independent factors and their variables, reliability analysis of the independent variables, one way ANOVA analysis of the independent variables and factor analysis of the independent variables This chapter was also included analysis of the dependent variable, deriving of the dependent variable, reliability of the dependent variable, research hypothesis, testing the hypothesis, summary and results of the hypothesis, bivariate correlations among independent variables, multiple regression between IT adoption and the independent variables, stepwise regression and discussions and conclusions.

g. Chapter 7: Impact of the Moderating Factors on the IT adoption and discussions

This chapter has dealt with the effect of the moderator variables on the IT adoption model derived in chapter six. The chapter includes the analysis of the moderator variables which includes the reliability of the IT moderator factors, one way ANOVA analysis of the moderating variables, factor analysis of the IT moderator factors, moderator variables and innovation models, types of moderator variables, moderator variables-theoretical background, hypothesis related to the moderator variables, MODPROPE –fundamental principles', statistical analysis of the moderator variables, summary of the tested moderator variables, results of the moderator hypothesis and discussions and conclusions.

h: Chapter 8: Conclusions and recommendations

This chapter includes main findings of this research, contribution of this research to the state of knowledge, the impact of this research finding on the current practice of organisations in Libyan construction organisations, and recommendation for further studies to be carried out in this field.

1.9 Conclusions

The main conclusions from the above explanation are as follows:

1. Nowadays the innovation and adoption of the IT in any business activities becomes a necessity for that business to survive the competitiveness and challenges in this new rapid changing world, O 'Regan, et al (2006), Becheikh, et al (2006), Bala Subrahmanya, et al (2009, 2010) and Tan et al (2011).

2. This study is designed to investigate the IT adoption in Libyan construction organisations. This is related to the fact that the Libyan construction industry is given little attention by researchers as hilighted by World Bank (1988) and Grifa (2006). Therefore, a study needs to be carried out in this important field of Libyan economy to investigate its current practices and the problems which face this sector.

3. Construction sector in any country is an important one which contributes positively to the economy of that country. Therefore, a study needs to be carried out to investigate this important sector and expand our understanding to its features and characteristics.

4. A model has been built based on the literature to study the Libyan constructions organisations in Libya. The model includes selected dependent, independent and moderator variables. 9 independent variables and 25 moderator variables will be used in this study. This gives the researcher the oppertunity to investigate the IT adoption in Libyan construction sector in deaitl.

5. To achieve the aim and objectives both qualitative (interviews) and quantitative methodologies (questionnaire) were used for this purpose.

Chapter Two: Review of literature

2.1 Introduction

This chapter deals with the literature review related to innovation in the organisations. It includes the definition of innovation-historical review, innovation IT adoption review which includes: Innovation Diffusion Theory (IDT), Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Diffusion of Technology Model (DTM), CENTRIM model, integrative innovation model, push-pull theory, tri-core model, absorption capacity, evolutionary perspective and other models. The chapter also includes which were divided into internal and external barriers. The internal barriers to innovation include: characteristics of the technology (such as the complexity and difficulty of using the IT system, compatibility of the technology, security of the information, cost of the IT system, cost difficulty to control, and technical, societal and inter-organisational barriers), management characteristics such as (resistance of manager/owner to change, lack of education of owner/manager, lack of commitment of managers towards their organisations, style of manager, age of owner/manager, lack of motivation and incentives schemes, lack of finance and lack of information about technologies), employees characteristics which includes (lack of skills and experience and employees attitudes toward innovation), organisation characteristics which includes (organisation size, organisation age and type of business). The external barriers includes lack of government regulations, lack of government/external financial support, unpredicted macro-economy, lack of national/international standards, lack of national ICT strategy, lack of students studying engineering sciences, lack of intellectual property rights, lack of cooperation with business partners and brain drain. The chapter also includes summary, types of software/hardware used and conclusions.

2.2 Definition of innovation historical review

In spite much literature has been published on innovation, but there is no common definition to the term innovation. . This point has been acknowledged by (Zairi, 1994). He indicated that it is very difficult to agree on a common definition to innovation and also to decide which firms are the most innovative and how to quantify the innovation activity. However, he considered innovation as the way of delivering quality to the customer both consistently and with economic viability.

Innovation has been defined by Jorde and Teece (1990: 76) as follows:
"Innovation is the search for and the discovery, development, improvement, adoption and commercialization of new processes, new products and new organizational structures and procedures"

An interesting paper presented by (McAdam et al, 1998) related to the differences between the concepts of total quality (TQ) quality and innovation in small business organisations. In their conclusions, they stated that *"innovation to be defined as an achievable step beyond that of total quality/continuous improvement in the current context, whilst the recognising there are branches of TQ and innovation that fall outside these categories".*

World Intellectual Property Organisation (WIPO, (2000: p. 4) in their discussion of the terms "invention and innovation" stated that "*the purpose of innovation is to create new value, be it for individual, team or organisation or for the society at large"*. They indicated that "*invention is to conceive the idea*", while innovation is "*to use the process by which an invention or idea is translated into the economy*". Value creation could take the form of:

- Breakthrough products or services
- New strategies
- New process, and
- New methods of organisation

It can be concluded from the above definitions that the term innovation comprises of four of four definition components as follows:

- The first component is related to a "new products or services" which could need the new "technology" to create the new products or services.
- The second component of the meaning of innovation is related to the adoption on new strategies. This means that if the adopting new strategy can add value to an organisation this means that an innovation processes has taken place.
- The third component of the above definition is "new process". This means that new processes or procedures that creates a new value to an organisation.
- The fourth component is "new methods of organisation". This includes organisation structure and a new managerial approach toward encouraging innovation.

An interesting definition to innovation has been presented by (Tiwari, 2008) as follows: *"An innovation is the implementing of a new or significantly improved product (good or service), or process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations. The minimum requirement for an innovation is that the product, process, marketing method or organisational method must be new (or significantly improved) to firm'.*

Tiwari (2008) indicated that the "innovation activities" include all the scientific, technological, organisational and commercial steps" which are required for the implementation of innovation. These activities also include R&D that is not directly related to the development of a specific innovation. Tiwari (2008) classified innovation into four main components as follows. First a product innovation, which means the introduction of a new good or service or significantly improved with respect to its characteristics or intended uses. Second a process innovation which means the implementation of a new or significantly improved product or delivery. Third, marketing innovation which means a new marketing method involving significant change in product design or packaging, product placement, product promotion or pricing. Fourth, an organisational innovation which includes the implementation of a new organisation method in the firm's business practices, workplace organisation or external relations.

A very interesting paper published by Massa and Testa. (2008) related to the Italian SMEs, indicates that there are different views in interpreting the term 'innovation'. These views are related to the main innovation stakeholders, entrepreneurs, academics, and policy makers. They indicated that these views show the existence of deeply different perspectives concerning innovation, starting from its definition, to the effective policies to promote it, to the role of intermediary institutions and so on and sometimes, these views show diverging goals among the stakeholders and, consequently, contrasting opinions on effective supporting policies. It can concluded from above explanation that in spite Italy is a European and developed country the meaning of the word "innovation" is still not well digested by the SMEs bosses, academics and policy makers.

An interesting summary of innovation definitions has been summarised by (Tinnesand (1973, cited in Cumming (1998, p.21). The researcher published the results of the definition of

innovation from 186 publications and found that the meaning of innovation as could be categorised into the categorises shown in table (2-1) below.

Table (2-1): Definition of innovation

No	Definition of innovation	%
1	The introduction of a new idea	36
2	A new idea	16
3	The introduction of an invention	14
4	An idea different from existing ideas	14
5	The introduction of an idea disrupting prevailing behaviour	11
6	An invention	9

Source: adapted from Cumming (1998, p.21)

It is clear from the definitions that there is no common definition to the term 'innovation'.

A recent review to the definition of innovation has been reviewed by Baregheh et al (2009). The researchers collected and analysed 60 definitions of innovation from various disciplinary literatures as shown in table (2-2) below.

Table (2-2): Definition of innovation –historical-review

	Discipline	**No of definitions**	**Years**
1	Business and management	18 definitions	from 1966 to 2007
2	Economics	9 definitions	from 1934 to 2004
3	Organisation studies	6 definitions	from 1953 to 2008
4	Innovation and entrepreneurship	9 definitions	from 1953 to 2007
5	Technology, science and engineering	13 definitions	from 1969 to 2005
6	Knowledge management	3 definitions	from 1999 to 2007
7	Marketing	2 definitions	from 1994 to 2004
	Total	**60 definitions**	

Source: adapted from Baregheh et al (2009, p. 1324)

Baregheh et al (2009, p. 1324) stated that '*whilst there is some overlap between the various definitions of innovation, overall the number of diversity of definitions leads to a situation in which there is no clear an authoritative definition of innovation'.*

In conclusion it can be said that there is no definitive and firm definition to the term "innovation". This could be related to that fact that there are many factors affecting the innovation. These factors are related to the technology characteristics, organisational/ managerial/people/administrative characteristic, and external factors. These will be explained

in more detail in this chapter. However, it can be said the term ‘innovation’ could mean a new idea, product, procedure and methodology.

2.3 Review of Innovation Adoption Theories

This section reviews the main theories and models used in the adoption and diffusion of the ICT in SMEs organisations. In this section the researcher will discuss the most important theories related to the innovation and diffusion of the ICT systems in the small and medium sized enterprises.

2.3.1 Innovation Diffusion Theory (IDT)

This theory has been developed by Rogers (1962, 1995). It is a broad social psychological, sociological theory called Diffusion of Innovations (DoI). The theory purports to describe the patterns of adoption, explain the mechanism, and assist in predicting whether and how a new invention will be successful. It is published in Rogers 'Diffusion of Innovations' originally published in 1962 and then in 1995 and 2003.

Rogers (1995:11) defined diffusion as “*the process by which an innovation is communicated through certain channels over time among the members of social system.* In the meantime innovation is defined as *“an idea, practice, or object that is perceived as new by an individual or other unit of adoption’*. The adoption rate was considered Robert and Christian (2007) as the speed that the new idea spreads from one customer to the next.

According to Garson (2006:1) there are four elements of Roger’s theory as follows:

1. An innovation (something as new),
2. A communication system (a transmission system from one individual, group, or society to another)
3. A social system (provides the domain for the diffusion process),
4. Time (from awareness of innovation through to adoption saturation in social system).

In the analysis of the diffusion theory each of the above-mentioned elements must be considered. Therefore, the effect of the following five factors should be considered Garson (2006: 1).

1. Characteristics of the innovation itself (e.g. complexity, compatibility with existing structure and methods, observability of benefits, relative advantage over existing forms, and trialability-the extent it can be tried out on an experimental or pilot basis).
2. Characteristics of communication channels (e.g. interpersonal, organisational, mass media).
3. Process characteristics (e.g. voluntary, mandated).
4. Characteristics of the social system (e.g. compatibility of the innovation with social norms).
5. Characteristics of the change agents promoting diffusion (e.g. technocrats vs. background in organisation development; low-level vs. high-level).

The Diffusion of Innovation (DoI**)** theory sees innovations as being communicated through certain channels over time and within a particular social system (Rogers, 1995). Individuals are seen as possessing different degrees of willingness to adopt innovations and thus it is generally observed that the portion of the population adopting an innovation is approximately normally distributed over time (Rogers, 1995). The processes of technology adoption are shown in Figure (2-1) below.

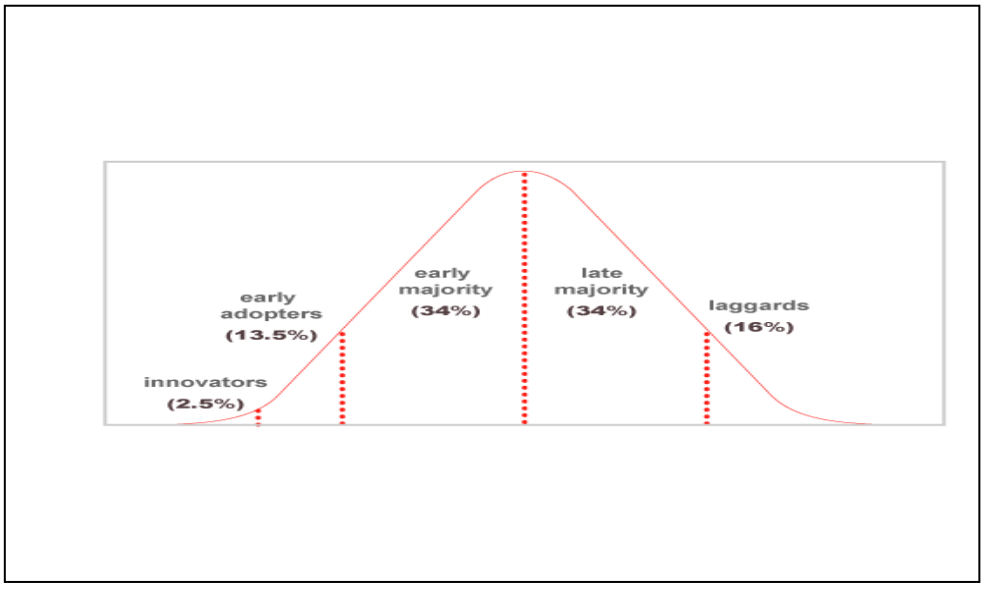


Figure (2-1): Diffusion Process (source: Gerrits and Hartigh (2010)

If the number of newly adopters frequency is plotted against time the result will be a bell-shaped Gaussian curve as shown in Figure (2-1). The number of adopters rises to half way after which their numbers decrease as shown in Figure (2-1). It is clear from the above

mentioned figure that five adopters' categories can be observed and their characteristics are explained below.

1. Innovators**:** this is the first 2.5% of the *adopters* are called '*innovators*'. Innovators are adventuresome, educated, have a lot of information and take risks in adopting the new innovation.
2. Early adopters: this category consists of 13.5% of adopters and is called 'early adopters'. They are social leaders, popular and educated.
3. Early Majority: This category formed 34% of the adopters. This category is attracted to use the new technology to change its working environment.
4. Late majority: this category takes 34% of the adopters. The adopters in this category are sceptical, traditional, lower socio-economic status and they are very price sensitive and require secure solutions.
5. Laggards: This category takes 16% of the adopters. The adopters of this category are sceptics and tend not to believe that technology can enhance productivity and are likely to block any initiative to adopt new technology akin to the Luddites of the early industrial revolution.

When the accumulated number of adopters is plotted against time the result will be the S-curve as shown in Figure (2-2) below.

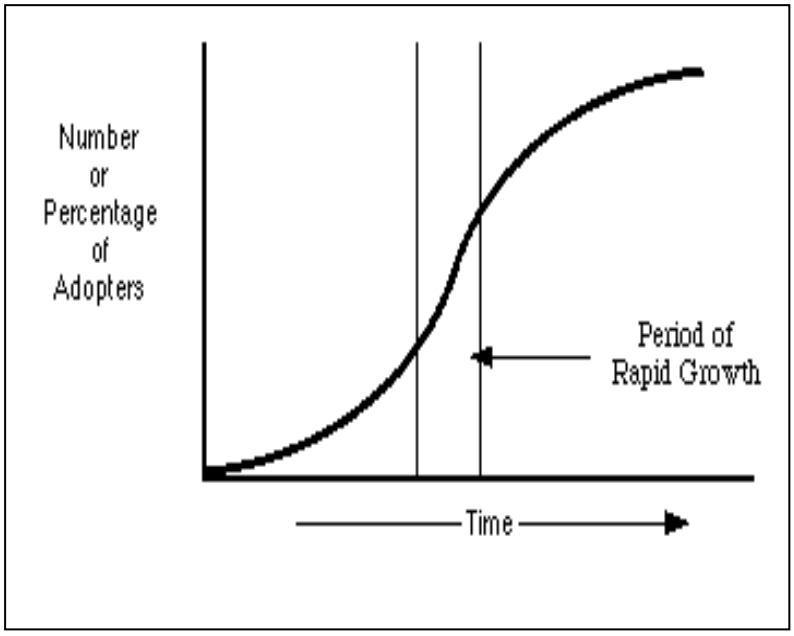


Figure (2-2): S-curve representing the rate of adoption of an innovation over time. (Source: Surry, 1997)

2.3.2 Technology Acceptance Model (TAM)

This model has been derived by Davis (1989) as a Technology Acceptance model (TAM) and is shown in Figure (2-3) below. The TAM model was developed to predict the user intension of using IT, Davis (1989), Rigopulos (2007) and Dyer (2008). The core constructs of the TAM are Perceived Usefulness (PU) and Perceived Ease Of Use (PEOU) are shown in figure (2-3) below and defined as follows:

The Perceived Usefulness (PU) is defined as '*the degree to which a person believes that using a particular system would enhance his or her job performance'*, Davis (1989, p.320).

The Perceive Ease Of Use (PEOU) was defined as '*the degree to which a person believes that using a particular system would be free from effort*', Davis (1989, p.320).

It is also that both (PU) and (PEOU) were shown in the model as having an impact on the attitude toward using the system (A), and the Behavioural Intention to use (BI) which leads to actual system use.

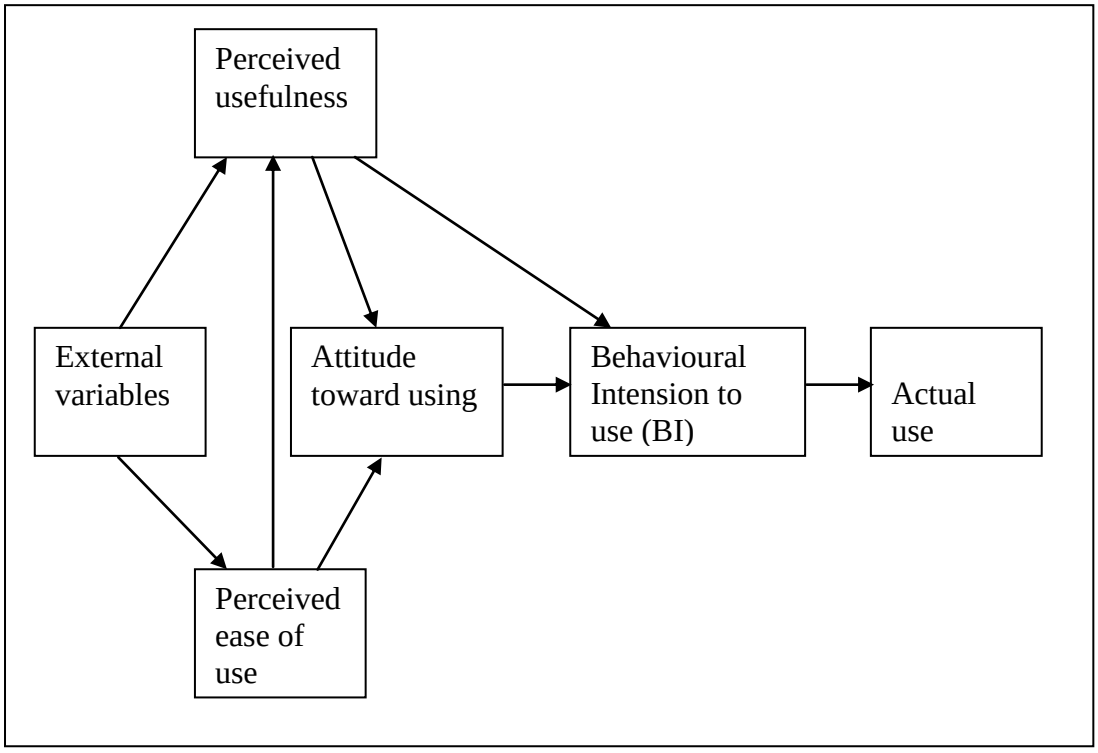


Figure (2-3): Technology Acceptance Model (TAM). (Source: Morris and Dillon, 1997).

The TAM model has been used by Rigopulos (2007) for measuring the users' attitude towards online electronic payments adoption. The researcher found that there is a positive relationship between ease of use and actual use of the new service.

Park (2009) indicated that the strength of TAM is that it contains two cognitive beliefs constructs 'perceived usefulness' and ease of use' and to account between 40 to 50% of user acceptance. TAM has evolved and extended to TAM2, Venkatesh and Davis 2000). The new version of TAM i.e. TAM2 included social influence (subjective norm, voluntariness, and image), cognitive instrumental process (job-relevance, output quality, and result demonstrability) and experience, Park (2009).

According to Mazhar (2006) the relationship between (PU) and PEOU is that U mediates the effort of PEOU on attitude and intended use. In other words, PU has a direct impact on attitude and use, PEOU influences attitude and use indirectly through PU.
The shortcomings of this model have been highlighted by Mazhar (2006). Mazhar (2006) criticised the model and stated that:
'This model with its original emphasis on the design of system characteristics does not account for social influence in the adoption and utilisation of new information systems'.

2.3.3 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh et al (2003) reviewed the available published literature in the field of Information Technology (IT) and introduced their United Theory of Acceptance and Use of Technology (UTAUT) mode. The UTAUT was created by reviewing 8 important theories. These are Theory of Reasoned Action (TRA), Fishbein and Ajzen (1975; Technology Acceptance Model (TAM), Davis (1989); Motivated Model (MM), Davis et al (1992); Theory of Planned Behaviour (TPB), Ajzen (1991); Combined of TAM and TPB (C-TAM-TPB), Taylor and Todd (1995a, 1995b); Model of PC Utilisation, (MPCU), Thompson et al (1991); Innovation Diffusion Theory (IDT), Rogers (1983, 1995); and Social Cognitive Theory (SCT), Compeau and Higgins (1995) Compeau et al (1999). A brief summary of these theories is shown in Table (2-3) below. One important point can be noticed in these theories is that some of them such as (TRA) and (SCT) are derived from the psychology sciences, while the others mixed the technology and human characteristics.

Table (2-3): Summary of the 8 innovation models.

No	Theory/Model	Source
1	Theory of Reasoned Action (TRA)	Fishbein and Ajzen (1975). This related to the psychology and human behaviour. It has two core constructs, attitude toward behaviour and subjective norms.
2	Technology Acceptance Model (TAM)	Davis (1989). This model is an extension of TRA. The model originally developed to predict IT acceptance and usage on the job, and then applied to various types of technologies and users. It has two main constructs perceived usefulness and perceived ease of use. TAM. Then TAM extended to TAM2, Venkatesh and Davis (2000) by adding subjective norm to TAM in the case of mandatory settings
3	Motivational Model (MM)	Davis et al (1992). This model used to understand the acceptance and usage of new technologies. The main constructs of motivation model are extrinsic motivation and intrinsic motivation
4	Theory of Planned Behaviour (TPB)	Ajzen (1991). This theory extended from TRA by Fishbein and Ajzen (1975) by adding the construct of perceived behaviour control. It has been used by researchers such as Taylor and Todd (1995b), Harrison and Mykytyn (1997) and Mathieson (1991) to understand of individual acceptance and the usage of various technologies.
5	Combined TAM and TPB (C-TAM-TPB)	Taylor and Todd (1995a, 1995b). This a hybrid model combined the predictors of TPB with the perceived usefulness from TAM
6	Model of PC Utilisation (MPCU)	Thompson et al (1991). This model presented by Thompson et al (1991) and based on human behaviour model presented by Triandis (1977). The MPCU model consists of six constructs: job-fit, complexity, long-term consequences, affect toward use, social factors and facilitating conditions.
7	Innovation Diffusion Theory (IDT)	Rogers (1983, 1995). This theory has been presented by Rogers (1983, 1995). The theory was set to explore the individual technology acceptance. The constructs of this theory are: relative advantage, ease of use, image, visibility, compatibility, result demonstrability and voluntariness of use.
8	Social Cognitive Theory (SCT)	Compeau and Higgins (1995) Compeau et al (1999). This is based on the human behaviour and psychology. It has five core constructs: outcome expectations-performance, outcome expectation-personal, self-efficacy, affect and anxiety.

In their reviewing to the 8 models Venkatesh et al (2003) addressed the following shortcomings of these models, Venkatesh et al (2003), Al-Qeisi (2009).

- The technologies studied were simple and individual-oriented as opposed to complex and sophisticated organisational technology.
- Most participants in these studies were students except a few studies.

- Time of measurement was general and in most studies well after the acceptance or rejection of the use of the technology
- The measurements were generally cross-sectional
- Most studies were conducted in voluntary usage and therefore it makes difficult to generalise the results to mandatory settings

The Venkatesh et al (2003) UTAUT model has four core constructs. These core constructs are: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions as shown in Figure (2-4) below.

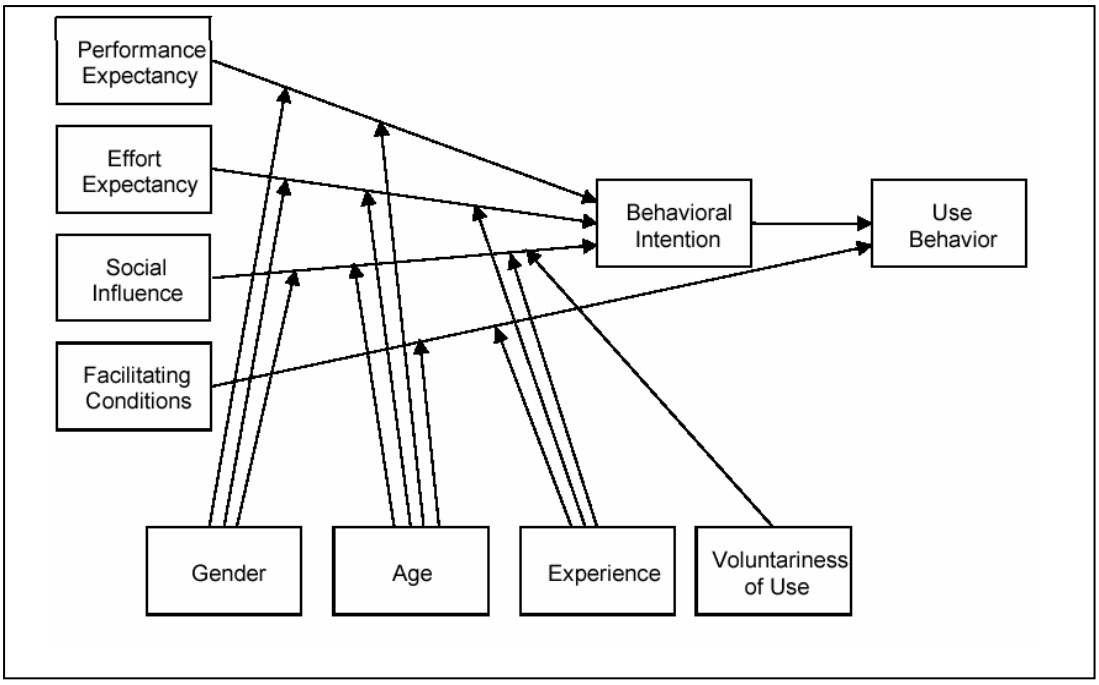


Figure (2-4): UTAUT developed by Venkatesh et. al., (2003), (Source: Marchewka et al 2007).

The definitions of the four constructs in the UTAUT are shown in Table (2-4) below.

Table (2-4): Core constructs of the UTAUT and their definitions

No	Construct	Prefix	Definition
1	Performance Expectancy	PE	'*The degree to which an individual believes that using the system will help him or her attain gains in job performance'* Venkatesh et. al., (2003, p.447).
2	Effort Expectancy	EE	'*The degree of ease associated with the use of the system'* Venkatesh et. al., (2003, p.450),
3	Social Influence- known as Subjective Norm by Fishbein and Ajzen (1975, p.302)	SN	*'The degree to which an individual perceives that important others believe he or she should use the system'.* Venkatesh et. al., (2003).
4	Facilitating Conditions	FC	*'The degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system'.* Venkatesh et. al., (2003),

Source: Venkatesh et. al., (2003)

At it has been clarified above that the derivation of the UTAUT model constructs was based on the reviewing of the 8 models in the field of Information Technology. These are explained and shown in Table (2-5) below, Rosen (2005) and Dyer (2008).

Table (2-5): Creation of UTAUT from 8 Old Models

	UTAUT construct name	Old models	Old construct name
1	**Performance Expectancy**	Technology Acceptance Mode, TAM, Combined Technology acceptance and Theory of Planned Behaviour (C-TAM-TPB, and Motivation Model (MM)	Perceived Usefulness
		Model of PC Utilisation (MPCU)	Job Fit
		Innovation Diffusion Theory (IDT)	Relative Advantage
		Social Cognitive Theory (SCT)	Outcome Expectations
2	**Effort Expectancy**	Technology Acceptance Mode, TAM, Combined Technology acceptance and Theory of Planned Behaviour (C-TAM-TPB, Motivated Model (MM)	Perceived Ease of Use
		Model of PC Utilisation (MPCU)	Complexity
		Innovation Diffusion Theory (IDT)	Ease of Use
3	**Social Influence**	Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB), Combined Technology Acceptance and Theory of Planned Behaviour (C-TAM-TPB)	Subjective Norm
		Model of PC Utilisation (MPCU)	Social Factors
		Innovation Diffusion Theory (IDT)	Image
4	**Facilitating Conditions**	Theory of Planned Behaviour (TPB), and Combined Technology Acceptance and Theory of Planned Behaviour (C-TAM-TPB)	Perceived Behavioural Control
		Model of PC Utilisation (MPCU)	Facilitating Conditions
		Innovation Diffusion Theory (IDT)	Compatibility

Source: adapted from Rosen (2005) and Dyer (2008).

It is clear from Table (2-5) that the four cores constructs of the UTAUT model depends on the constructs of the old models. This means that the performance expectancy depends on (perceived usefulness, job fit, relative advantage and outcome expectations); effort expectancy depends on (perceived ease of use, complexity and ease of use); social influence depends on (subjective norm, social factors and image); and facilitating conditions depend on (perceived behavioural control, facilitating conditions and compatibility). The *gender, age, experience and voluntariness of use* were considered as moderating variables.

The UTAUT aims to explain user intentions to use an information system (IS) and subsequent usage behaviour. Venkatesh et al., (2003) tested the UTAUT model and found that the model was able to account for 70% of the variance in usage intension which is better than the old models which were found to account for 40% percent of the variance Al-Qeisi (2009).

Kijsanayotin et al (2009) applied UTAUT model to the Thailand's health sector. They indicated that one of the most important factors for success of heath information technology (IT) implementation is users' acceptance and use of that technology. They found that IT acceptance is influenced by performance expectancy, effort expectancy, social influence and voluntariness. They also indicated that heath IT use is predicted by previous IT experiences, intension to use the system, and facilitating conditions.
The proposed model has also been positively reviewed by researchers such as Anderson and Schwager (2004).

A study has been conducted by Oshlyansky (2007) to validate the UTAUT model in nine different cultures countries: Czech Republic, Greece, India, Malaysia, New Zealand, Saudi Arabia, South Africa United Kingdom, and United States. The aim of the study was to collect data from countries around the world to cross-culturally validate the UTAUT tool. They concluded that the model is valid for different cultures. The researchers didn't use the model as has been presented by Venkatesh et al.(2003) to predict the use of the technology. Therfore, the findings of this research need to be varified due to the following reasons:

- They indicated that since the research did not seek to predict usage or acceptance of a particlare application, certain meaures on UTAUT were excluded. *Behaviour intentsion* to use was dropped –as it is intednded as a predictore of use. *Faciltating conditions* was also excluded and many questions were also altered.
- The data used in their tests was collected from the postgraduate and undergraduate students by using websites and this doesn't necessary reflect the organisations natural work conditions in different cultures.

Pu Li and Kishore (2006) carried out an evaluation to the constructs of the UTAUT presented by Venkatesh et al (2003). They collected their data from 265 business school undergraduate students in the USA on the subject of acceptance of online community Weblog systems. They analysed the collected data using multiple group invariance analysis to asses the equivalence of the UTAUT scales across different subgroups based on gender, general computing knowledge, Weblog-specific knowledge, experience with Weblogs, and frequency of using Weblogs. They found from their results that scales for the four constructs in the UTAUT including performance expectancy, effort expectancy, social influence, and facilitating conditions have invariant true scales across most but not all subgroups. They highlighted the

point that researchers and practitioners, therefore need to apply caution when interpreting the results from the UTAUT instrument.

Ristola (2006) studied the consumer perceptions of mobile technology in Finland in his PhD thesis programme. He tested the UTAUT technology acceptance model derived by Venkatesh et al.(2003) as a tool to explain the consumers acceptance of the mobile acceptance in the Finns mobile business market. He found that the UTAUT model does not completely apply to predict consumer's intention to start using the mobile services. For this reason he suggested modified to the model to fit his research requirements.

As a conclusion it can be said that the UTAUT model is a positive step forward but it doesn't mean that it can be considered as a definitive theory in the field of innovation and adoption of the technology in SMEs around the world.

2.3.4 Diffusion of Technology Model (DTM)

Other researchers, Peansupap (2004) and Walker and Peansupap (2004) have studied the diffusion of the innovation within the Australian construction industry and have indicated that there are eleven factors which affect the diffusion of the IT in the construction industry. These factors and their variables are shown in Table1 (2-6) below.

Table (2-6): Factors affecting the diffusion of the ICT system in construction industry

Factors	Its variables
Training & learning support	Sufficient time to think
	Flexibility for learning
	Work procedure support
	Enough time for training
	Technical support
	Enough quality of training
	Functionality/ Ease of use ICT
	Easy to observe benefit of using ICT
	Trial and experiment ICT
	Mentoring support
Clear advantage of use	Clear advantage of using ICT for coordinating teams
	Clear advantage of using ICT for communication between teams
	Clear advantage of using ICT for communication within team
	Receive professional creditability
	Clear advantage of using ICT for decision-making
	Relevance to personal job
Individual/Personal characteristics	Basic skill of using ICT
	Personal confidence
	Enjoy exploring /exposure to new tools
	Personal capability to learn ICT
	Mentoring program
	Personal commitment

Technology characteristics	Functionality of ICT
	Accessibility of ICT
	Response rate of ICT
Supervisor support	Supervisor encourage use
	Supervisor openly suggests improvement using ICT
	Trust with supervisor on making mistakes
	Organisation support sharing ICT experience
	Enjoy learning from others
Open discussion environment	Organisation openly discusses about ICT difficulty (group)
	Person openly discusses about ICT difficulty
	Organisation openly suggests on improving using ICT
	Organisation commitment (resources)
Tangible and intangible rewards	Receive tangible rewards
	Provide tangible rewards in sharing ICT experience
	Provide intangible rewards in sharing ICT experience
Colleague help	Colleagues informally help on using ICT
	Colleagues formally help on using ICT
Positive of using new technology	Better than previous
	Speed and reliability of ICT
	Compatibility with previous system/work procedures
Negative environment	Feel pressured to be effective in using ICT
	Personal anxiety
Barrier of using ICT	Difficult, complex or frustrating to use ICT

Source: Walker and Peasupap (2004)

Peansupap (2004) has studied the ICT innovation in the Australian construction organisations and proposed the following model to express the factors, which influence the innovation of the ICT. The model is shown in Figure (2-5) below. According to this model shown in Figure (2- 5) that the diffusion of ICT innovation within organisation dependents on three factors. The first factor is the 'static factor'-(technical characteristic, communication channel, and social system); the second factor 'dynamic factors of change of management' (motivation, training/technical support, supervision and open discussion), while the third factor 'dynamic factors-learning and sharing knowledge (sharing IT knowledge with others). This will lead to the diffusion of the technology within organisation at implementation.

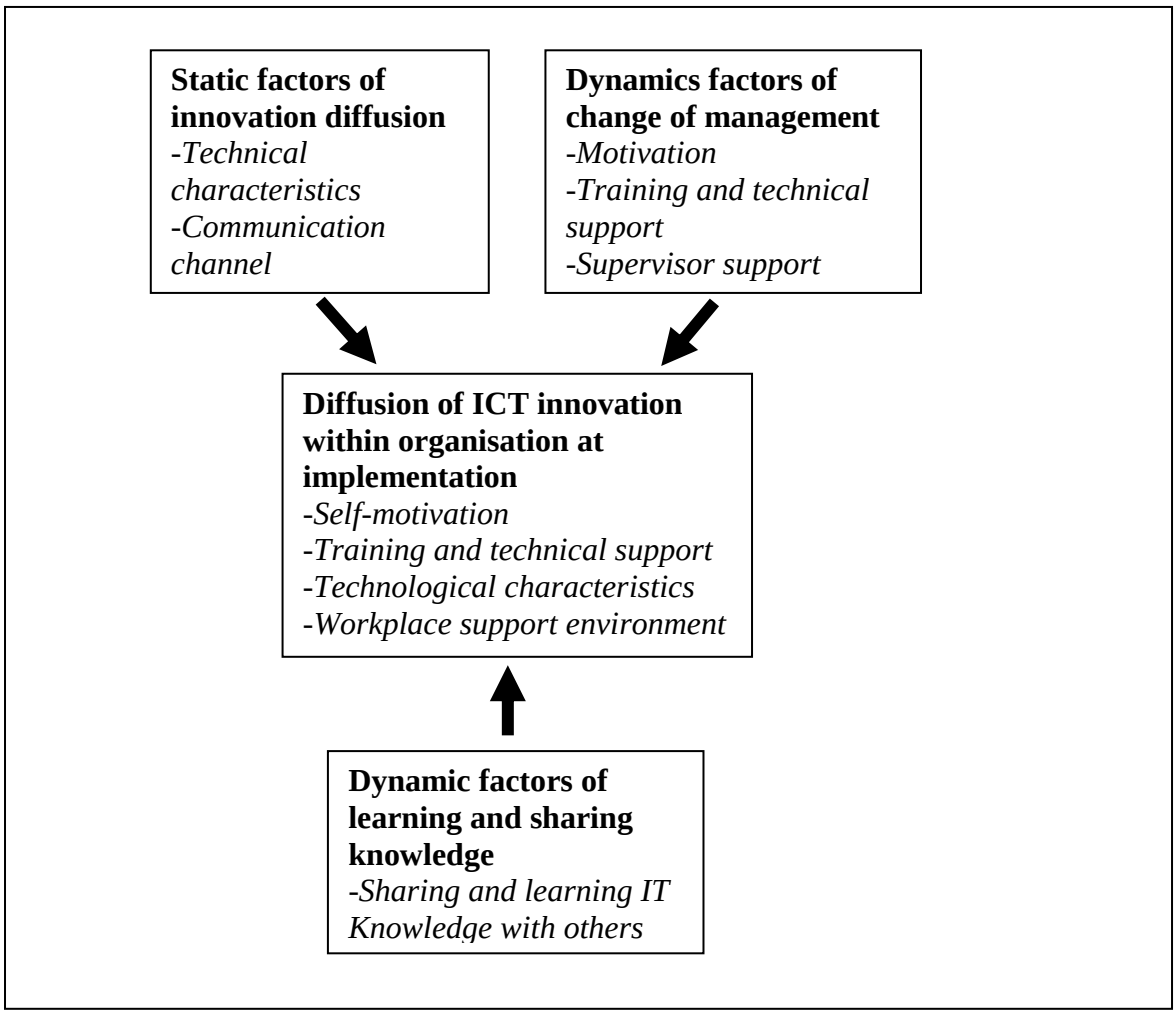


Figure (2-5): Integration of factors related to ICT diffusion from innovation diffusion, change management and learning and sharing concepts, Peansupap (2004: 96)

The sample used in the study was 117 SMEs from Australian construction organisations. The study could be considered as step forward in understanding the construction innovation and adoption in construction industry. However, there is shortage in the studies carried out in the construction field. For example Graifa (2006), Twati (2006) have indicated that the IT has not yet widely used in Libyan construction industry and this field needs to be investigated due to its importance and contribution to the Libyan national economy.

2.3.5 CENTRIM Model for assessing the innovation in SME's

This model has been developed by the Centre of Research in Innovation Management, (CENTRIM), Brighton University, for assessing the innovation in SME's. The model has been described by Bessant and Francis (1999), Woodcock and Francis (2001), Tidd et al (2005), (McAdam et al, 1998, 20002, 2004, 2008), and Nicolls (2005). The merit of CENTRIM innovation model is that it covers both technological and managerial aspects of

innovations (McAdam et al , 2004). The CENTRIM innovation model covers 6 main components which includes 18 sub-components as shown in Table (2-7) below, (McAdam et al, 1998, McAdam et al, 2004).

Table (2-7): Components of the CENTRIM model

1		**Directing a creative business**
	1.1	MD support for new ideas
	1.2	Business plan showing when changes are needed
	1.3	Speed of change when superior methods are available
2		**Developing creative capacity**
	2.1	Individuals with creative ideas
	2.2	Capabilities needed for success
	2.3	Change efficiency
3		**Building a creative culture**
	3.1	Encouraging staff to take initiative
	3.2	Objectives for new ideas
	3.3	Mutual support for new ideas
4		**Managing learning for new ideas**
	4.1	External access for new idea sources
	4.2	Availability of experienced people
	4.3	Staff up-dating with best practice
5		**Organising for creativity**
	5.1	New product introduction efficiency
	5.2	Support for new ideas from the top
	5.3	Organisational structure to support creativity
6		**Taking wise decisions**
	6.1	Resources to develop ideas
	6.2	Consideration of ideas before decisions are made
	6.3	Plan for development

Source: (McAdam et al, 1998, 2004)

It seems from the above table that the CENTRIM includes both of the managerial and technological aspects of innovation. The role of the top management in directing a creative business, developing creative capacity, building a creative culture, making learning from new ideas, organising for creativity, and taking wise decisions are vital factors in promoting any innovation.

It has been highlighted by Nicolls (2005) that the innovation aspect includes 4 Ps :
Product innovation-, which includes –good, services;
Process innovation- which includes- production technology or systems, administration systems, and supply chain;
Business Paradigm- which includes business philosophy, staff policy, management style
Market Position-, which includes exploitation of territorial areas, penetration of new market or market segment.

Nicolls indicated that innovative leadership with creative culture, high expectations, strong decision making, effective project management and enabling processes create innovation creates innovation environment. It can be said that Nicolls 4 Ps come in concise with the technological and managerial aspects of innovation included in the CENTRIM model. The Product innovation and Process innovation covers the technological side of the innovation while the Business Paradigm and Market Position covers the managerial side of the innovation.

McAdam et al (1998) compared managers in Total Quality and in an innovation environments and concluded that the innovation model is mostly people, culture and leadership focused whilst the Total Quality model was more process based.

The components of the CENTRIM model have been represented in Figure (2-6) below, (McAdam et al, 2002, 2008).

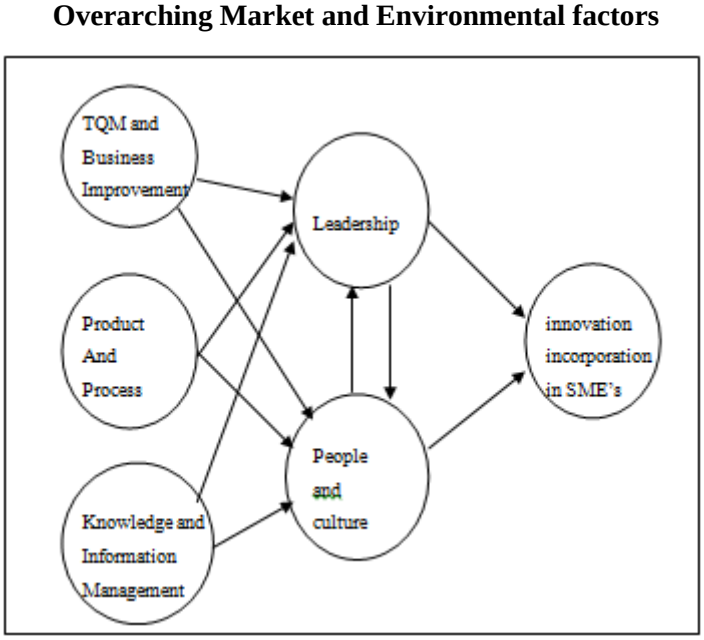


Figure (2-6): The innovation model for SME's , (McAdam et al, 2002, 2008)

It can be seen from Figure (2-6) that the leadership, and people and culture are the most critical factors, which promote Total Quality Management (TQM) and business improvement, product and process, and knowledge and information management. In other words the innovation environment depends on the leadership and employees and their pro-active role in promoting managerial and technological aspects of innovation. In addition to

those the external factors such as market, economy, etc have also impact on the innovation environment in an organisation.

The weakness of the CENTRIM model is that it doesn't include the 'country culture', it includes only the organisational culture and it is developed to fit the western culture which is different from the developing countries especially Arab culture. The country culture was found by AL-Solbi (2006) to be an important factor in assessing the electronic readiness (e-readiness) in Saudi Arabia organisations.

The CENTRIM model, which has been based on both organisational and technological aspects, has been used to assess the innovation in Irish SME's, McAdam et al (2002) and to assess the innovation in British SME's, McAdam (2008). In both cases the researchers used the model shown in Figure (2-6) above to examine the impact of both the leadership and people and culture on the Total Quality Management (TQM) and business improvement, product and process, and knowledge and information management. In both studies both qualitative (semi-structure interviews), and quantitative approach (survey) were used to collect their data for analysis. For example, McAdam et al (2002) have used the CENTRIM model to assess the Irish SME's. They used both qualitative and quantitative methodology to achieve their objectives. To formulate their questionnaire, they piloted their formulated questionnaire to 10 SME's and 10 academics working in related discipline in SME's experiences. The final version of their questionnaire consisted of 84 closed questions related to each of the areas shown in Figure (2-6) above. Five-scale questionnaire was used (-2= strongly disagree to 2= strongly agree).
The areas of the questions used in the CENTRIM model are shown in Table (2-8) below, McAdam et al (2002):

Table (2-8): The areas of questions used in CENTRIM model, to assess Irish SME's

	Model components	Number of questions	Comments
1	Leadership	13 questions	This section includes questions related to the role of the leadership in the organisation.
2	People and culture	17 questions	This section includes questions related to the issues of organisational culture and change, communications and performance (including target setting).
3	Total quality and continuous improvement	13 questions	This section included questions related to the manufacturing operations.
4	Product and process	27	This section included questions related to the new product and process innovation and improvements. This section concentrated on the technological capabilities of the companies.
5	Knowledge & information	14	This section contained questions related to the issues on transfer and management of knowledge and information within the organisation.

Source: McAdam et al (2002).

It is clear from Table (2-8) that the utilised questionnaire includes both managerial and technological aspects of innovation.

2.3.6 Integrative innovation Model presented by Tidd el al (2005)

Tidd et al (2005) presented an integrative approach to innovation management. Their model depends on five main pillars: strategy, processes, organisation, linkages and learning as shown in Figure (2-7) below.

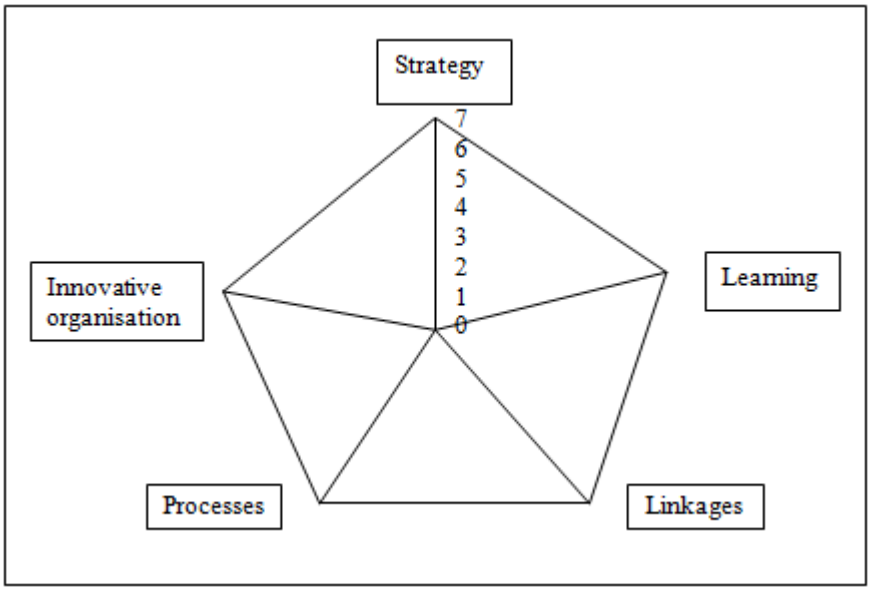


Figure (2-7): Innovation model presented by Tidd et al (2005)

Tidd et al (2005, p564) state that "an organisation with no clear innovation strategy, with limited technological resources and no plans for acquiring more, with weak management, with poor external links and with a rigid and unsupportive organisation would be unlikely to succeed in innovation." They classified organisations in relation to innovation into 4 scales as follows:

1- Innovation not even thought about, rarely happens;

2- Some awareness but random and occasional responses, informal systems;

3- Awareness and formal systems in place, but could still be improved;

4- Highly developed and effective systems including provision for improvement and development

It can be concluded from the above explanation is that researchers indicated that in order to create an innovation environment both organisational and technological factors should be considered.

2.3.7 Tri-core Model

This model has been presented by Swanson (1994). Swanson's (1994) tri-core model of IS innovations suggests that a knowledge deficit in one or more of the cores – the *administrative core*, the *technical (business) core* and the *IS core* – can cause IS innovations, such as systems development projects, to fail, Mitchell and Nault (2005).

Grover et al (1997) carried out carried an empirical study using the Tri-Core model and they stated that' 'results of this study provide partial support for the proposed hypotheses, leading us to conclude on an optimistic note regarding the viability of this model as an integrating frame-work for IS innovation'. While Mitchell and Nault (2005, 2006) used the model and found out that together the main effects of the tri-core model do not explain project performance, however core alignment in the form of interactions explains both process and product measures of project performance.

2.3.8 Other models

1. First Model: The first model has been presented by Thomas (1999). Thomas has developed his model to express technology diffusion in SMEs. He indicated that the rate of technology diffusion (speed at which a new technology accepted) depends on the characteristics of the SMEs and on the characteristics of the technology itself. He proposed a diffusion model built on the theoretical model of Centre Periphery Model presented by Schon (1971). The main assumptions which were considered in the periphery model are shown below, Thomas (1999).

1. The technology to be diffused exists prior to its diffusion,
2. Technology diffusion takes place from the source outwards to the SMEs, and
3. The support of technology diffusion involves incentives, provision of resources and training.

The model divided the SMEs want to utilise the technology as innovative SMEs, Early adopters, Early majority, and Laggards. This comes in concise with the diffusion of innovation theory (DoI) presented by Rogers (1995).
He indicated that the network communication (formal and informal) between the external sources such as universities, research centres and between SMEs themselves is vital in diffusing the technology within organisations.

2- Second Model: An interesting model related to the e-commerce in SME , i.e E-coSME has been presented by Sadler-Smith and Dawson (1998). One of the interesting proposals related to the e-commerce depends on three determinants:

1. Individual/personal readiness- the individual readiness includes abilities, skills and motivation to handle ICT equipment and applications and there is sense for the future opportunities. This point also found to be an essential factor in promoting the ICT diffusion in organisations Al-Solbi(2006).

2. Organisational readiness- the organisational e-readiness seen by Pricewaterhouse Cooper as 9 areas as follows: strategic focus, *organisation of processes in the value chain, managing performance, organisational capabilities, security, the use of enabling technologies, tax planning, legal implications* and *daily operations*. Al-Solbi(2006) studied the e-readiness in Saudi Arabia organisations and found that the organisation e-readiness is affected by the knowledge of the workforce, security of the information, government regulations and laws and the Marco economy.

3. Socio-technical readiness- this includes *connectivity, e-leadership, e-commerce consumer and business adoption, information security, human capital, business environment, business climate, legal regulatory environment, supporting services and social cultural infrastructure.* The Above points have also been highlighted by Al-Solbi (2006) in his study to the e-readiness in Saudi organisations. The availability of the ICT infrastructure and the leadership play vital roles in promoting the diffusion of the new technology.

2. Third Model: The Third model is presented by the British library research team related to e-commerce as shown in Table (2-9) below:

Table (2-9): SMEs stages of adoption and use of e-commerce

Stages	**Readiness issues**		
	Individual/personal	*Organisational*	*Socio-technical*
Non-involvement: Indifferent, hostile, naïve, ignorant	Lack of or conflicting personal lifestyle/career, motivations.	Lack of resources/structure; not employed	Low ICT familiarity; education and cultural barriers
↓	**Drivers**: peer/family pressure; growing ICT work, leisure domains **Barriers**: Educational; low ICT contact/familiarity; anti-tech lifestyle		
Threshold: Keen to benefit from ICT but not sure how	Low technical understanding; curious about ICT potential for business	Some demand for internal and external connectivity (from some staff and some customers); have PCs but not connected to internet	Customers/peers online and using e-mail; government, hardware and software supplier promotional materials; local provision of ISPs, telecoms, etc.
↓	**Drivers**: business pressures; CEO curiosity; staff ICT familiarity **Barriers**: lack of resources/technical expertise; less of CEO power to staff		
Beginner: Recently online but unsure of where to go next	Owner/CEO keen to gain business advantages from ICT; some employees with technical capability	e-mail used internally and in sales/customer liaison activities; dependency on key workers; low tech/people resources for considering internet options for the firm	Low awareness of range of applications; some access to external advice; source of helpful advice not obvious
↓	**Drivers:** strong CEO motivation; benefits from e-mail; increase ICT aware. **Barriers**: lack of resources/experience; cost of software/hardware		
Intermediate: Active use of e-mail, limited/passive use of website, no ICT strategy	Owner/CEO developing personal ICT knowledge and skills; most staff with basic ICT skills, some with advanced skills; strong motivation to develop the ICT potential of the firm	Internet used for specific external and business information; e-mail contact with suppliers; static website	Need for as advice and support networks
↓	**Drivers**: strong supply-chain/marketing pressures; justify ICT investment **Barriers**: inter-operability; systems/standards compliance; expert support		
Advance: Intranet/extranet online connectivity with customers, suppliers, and staff as integral part of total business strategy	Owner/CEO and most staff continuously developing ICT knowledge and skills	ICT strategy an internal part of business plan; staff recruitment and induction to develop firm's ICT capabilities; full internal e-mail intranet; web based	Clear regulatory and legal frameworks

		intranets/extranets with suppliers and customers; interactive web site as part of marketing and customer support strategy	
↓	**Drivers**: competitive advantage from ICT expertise/organisational knowledge **Barriers**: keeping up with pace of change in technology and market demands		
Innovative: Capability to exploit ICT strategically in process/product innovations	High ICT literacy; entrepreneurial; managers and key workers capable of effective autonomous working	Strong corporate vision; effective interactive networking with suppliers, customers and strategic partners; business strategy based on gaining competitive advantage through effective exploitation of ICT applications	Strong but flexible supply-chain, strategic partnership and support networks; effective systems to protect IPR; effective knowledge management systems internally and externally.

Source: Sadler-Smith and Dawson(1998)

The above model shows the stages of the model and their individual, organisation and socio-technical characteristics.

3. Fourth Model: A fourth model has been presented by El-Gohary et al (2007) as shown in Figure (2-8) below. Researchers studied factors affecting the adoption of e-marketing in small business enterprises in UK. The researchers'-marketing model relies on four ICT systems: *Internet M, Intranet M, E-mail M, Extranet M and Mobile M*. The selection to the above mentioned four pillars of the model relies on the definition of the e-marketing given by Strauss and Frost (2001) which state:

"The use of electronic and applications for planning and executing the conception, distribution and pricing of ideas, goods and services to create exchanges that satisfy individual and organisational objectives"

The constructs of the model used in the researchers' study are shown in Figure (2-8) below.

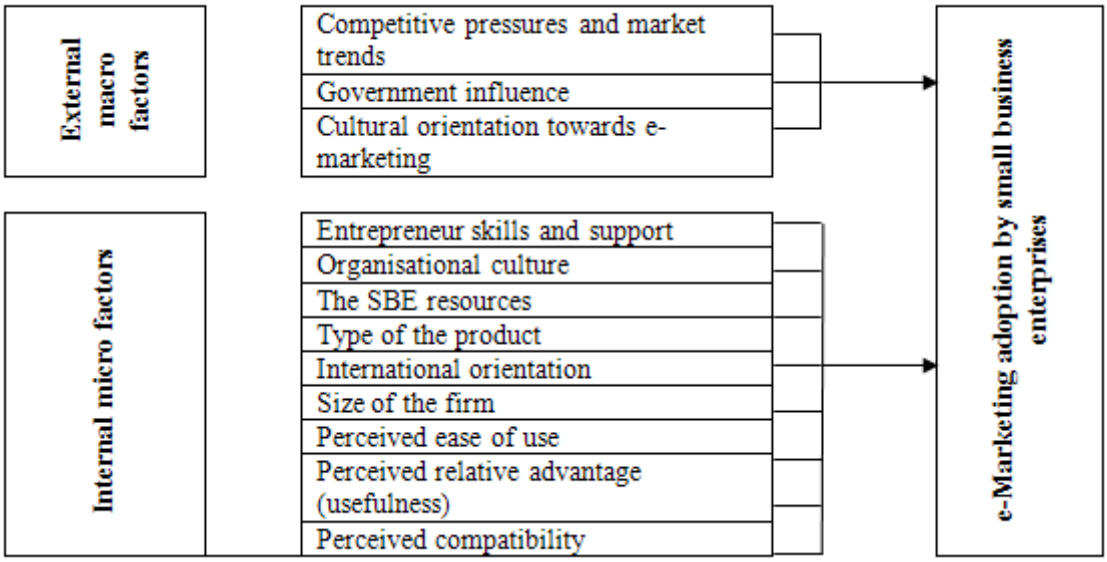


Figure (2-8): e-marketing model for Small Business Enterprises (SBE), Source: El-Gohary et al (2007)

The model used factors included in the Innovation Diffusion Theory, IDT, Rogers (1995) (discussed in section 2.31), and on Technology Acceptance Model, TAM (Davis, 1989) (discussed in section 2.3.2). Statistical tests were used to find out the impact of both the external and internal factors on the e marketing presented in the model. The researchers found that small business internal factors, ease of use, relative advantage and compatibility have a significant positive impact on e-marketing adoption. The surprising thing is that they found that most of the small businesses external factors *do not have* a powerful impact on e-marketing adoption by SBEs. This means that the internal factors are the most important issues that affect the adoption of e-marketing in SBEs. The obtained results of the statistical tests are shown in Table (2-10) below:

Table (2-10): Summary of results of TAM/IDT, SBE internal and external factors

Accepted hypotheses		Rejected hypotheses	
Adopting e-marketing by the SBE's is dependent on the entrepreneur (owner) skills and support	Accepted	Adopting e-marketing by the SBE's is dependent on the available resources	Rejected
Adopting e-marketing by the SBE's is dependent on e-marketing perceived ease of use	Accepted	Adopting e-marketing by SBE's is dependent on the SBE's organisational culture	Rejected
Adopting e-marketing by the SBE's is dependent on e-marketing perceived relative advantage (usefulness)	Accepted	Adopting e-marketing by SBE's is dependent on the SBE's organisational culture	Rejected
Adopting e-marketing by the SBE's is dependent on e-marketing perceived compatibility	Accepted	Adopting e-marketing by the SBE's is dependent on the international orientation of the SBE's	Rejected
There is a positive relationship between cultural orientation towards e-marketing by the SBE's customers and e-marketing adoption by the SBE's.	Accepted	Adopting e-marketing by the SBE's is dependent on the SBE's size	Rejected
		There is a positive relationship between market trends and competitive pressures and e-marketing adoption by the SBE's	Rejected
		There is a positive relationship between government influence and e-marketing adoption by the SBE's	Rejected

Source: El-Gohary et al (2007)

2.3.9 Push-pull Theory

Kolodovski (2006) in his report related to the 'push-pull' thinking stated that:

'Scientific innovation takes two distinct paths. Sometimes, companies ask researchers to develop a solution for a specific business problem. This is a demand-driven, "PULL" method. In other cases, scientists develop a technology with new valuable capabilities, and then search for commercial applications. This is a supply-driven, "PUSH" method. Whether innovation should be supply-pushed (based on the new technological possibilities) or demand-led (based on the social needs and market requirements) has been a hotly-debated topic. One point of view is that recognition of demand is a more important factor in successful innovation than recognition of technical potential. The alternative point of view is that the discovery of the new capabilities often leads to the more radical innovations'. Kolodovski also pointed out that in any innovation, researchers should have deep knowledge of both a problem and a solution, and if researchers learn a customer problem first, and then find a solution, he called this "*Pull method"* and under this method commercial applications are known before the

development of technology; and if researchers develop new technology capabilities first, and then search for problems to be solved with these technological capabilities, this is called "*Push method***"**.

Zmud (1984) has tried to integrate the three major research areas related to innovation in organisation i.e. organisational science, engineering /R & D management and management information system (MIS or MS) implementation into one perspective. His aim was to validate the 'pull-push' theory which (hypothesized that innovation will occur most often when a need and a means for resolving this need are recognized simultaneously) the diffusion of six modern software practices into 47 software development groups. He argued that the 'push-pull' theory did not appear to be an important predictor for the model. The author argues that the theory has to be extended to include both social as well as technological issues. He stated that: *"A number of explanations are offered for the apparent failure of `push-pull' theory. Top management attitude and organizational receptivity toward change, however, were generally found to influence organizational innovation. As hypothesized, significant differences emerged in the factors influencing administrative and technical innovations with organizational receptivity toward change important only for the technical innovations. This suggests that organizational processes facilitating innovation should vary depending on the nature of the innovation involved."*

2.3.10 Absorption Capacity

This is also an approach used by researchers to explain the adoption and diffusion of new technologies in organisations. Cohen and Levinthal (1990, p.128) in their discussion to the term absorption capacity stated that '*the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends is critical to its innovative capabilities'.* The authors called this capability a firm's '*absorptive capacity'* and suggest that it is largely a function of the firm's level of prior related knowledge.

While Bi and Yu (2008) look to the absorption capacity as a dynamic process in adopting ICT systems by organisations. They see the IT absorption by organisations as a spiral process, during which IT absorptive capacity evolves dynamically and, consequently, promotes IT use. They indicated that the dynamic process of IT absorptive capacity involves six forms: identification, adoption, adaptation, acceptance, infusion, and knowledge management. However, this theory is not widely used by the researchers.

2.3.11 Evolutionary perspective

According to Kemp and Soete (1992) the evolutionary perspective see economic growth and technological change are viewed as a complex, non-linear, path-dependent process, driven by short-term benefits instead of longer- term optimality.

Pennings and Harianto (1992a, 1992b) have discussed the tendency of diffusion of technological innovation in commercial banking industry. They indicated that technological innovations evolve from the stock of skills which organisations have accumulated over time. They also highlighted that the linkage of organisations with extramural sources of technology are also presumed to be important in encouraging the technological innovations. This approach considers that innovations evolve from the accumulative skills and knowledge which can be utilised in the strategic innovation planning. The importance of linkage with external sources is also an important factor which helps in technological innovation within organisations. There is some overlap between information technology experiences and interfirm linkages because some linkages are formed for the purpose of implementing technological investments. The greater a bank's inclination to network with information technology firms, the greater the probability it will adopt video banking, Pennings and Harianto (1992a).

2.4 Barriers to Innovation

After the above introduction to the term innovation, it is appropriate to discuss barriers faced by the innovation. By knowing these barriers it is possible to surmount or at least minimize them in order to allow innovation to flourish. Their relevance to this particular project will be demonstrated.

According to Piatier, (1984) there are many multi-faceted and inter-related issues which can assert a negative influence and in some cases completely block the flow of innovatory progress. Enterprises that could benefit from the introduction of new ideas, products or systems in order to merely survive, let alone increase their market share in an increasingly competitive environment need to construct a conceptual framework based on knowledge and experience of those barriers likely to be met and formulate policies to counter them.

In order to simplify the explanation of the barriers face organisations, it has been found appropriate to divide them into internal and external barriers. The decision is built on the literature Antonia et al (2009). Antonia et al (2009) reviewed the barriers face innovation in

Spanish manufacturing SMEs and classified them as "internal and external barriers". They state:

"Internal barriers are those that originate within the firm, whereas external barriers are those that originate from the firm's external environment".

According to their classification the internal barriers include: high costs, innovation cost difficult to control, excessive risk, lack of qualified personnel, difficult access to financial resources, problems keeping qualified employees, lack of internal training, employee resistance to change, manager resistance to change, while the external barriers include: insufficient government support, economic turbulence, lack of market information, lack of information about technologies, and lack of external partners possibilities.

Other researchers highlighted other barriers to innovation such as national strategy, Aubert (2004), legislation, regulations, norms and standards (Levratto, 2009), security-issue and internet fraud (Stockdale and Standing, 2006).

In the light of the above classification i.e "internal" and "external" barriers and in the light of other literature the researcher has decided to classify these barriers as internal and external.

2.4.1 Internal barriers

These barriers are within the environment of the organisation as mentioned above. These barriers could be related to the management characteristics such attitudes towards the innovation, leadership, managers owner willingness to adopt ICT system, employees characteristics such as age, gender, experience, willingness to use new technologies, for example, Venkatesh et al (2003, Peterson (2003), Tapp et al (2003) , Fryling (2012), and technologic characteristics, such as perception of ease of use, benefits, complexity, compatibility of software/hardware and cost of the technology, for example Rogers (1995), Venkatesh et al (2003, (McAdam et al, 2002, 2008. The most important barriers which have been found in the literature are explained below.

In order to simplify the discussion of the internal barriers to innovation, this section has been organised to discuss the characteristics of the technology such as complexity and difficulty of using the technology, compatibility of the technology, security of the information, high costs of the technology, innovation costs difficult to control, and technical, societal and inter-organisational barriers. It will also discuss the management characteristics such as resistance of manager/owner to change, central control and less power to managers to take decisions,

lack of education of managers/owners, lack of commitment of managers towards their organisations, style of manager, gender issue, age of the manager/owner, lack of incentives schemes, lack of finance, and lack of information about technologies. In addition it includes the employees' characteristics such as lack of skills and experience, employees' attitudes towards innovation, and cultural factors. Nevertheless it includes the organisation characteristics such as organisation size, organisation age, type of organisational business, and lack of organisation slacks.

2.4.1.1 Characteristics of the technology

Many researchers have reviewed the technology characteristics. For example Rogers (1995) highlighted the benefits ease to use and usefulness, and Scupola (2003) highlighted the importance of technology availability. Other researchers such as KIMI (2002), and Lee and Kim (2004) highlighted the cost of technology adoption. Other researchers highlighted the security hazards Purao and Campbell (1998), Ministry of Information and Communication (MIC, 2002), while Abell and Lim (1996) highlighted the security of the Internet by the risk of interception of messages send via the technology.

An interesting study has been carried out by Lee and Kim (2004) on factors and barriers of Information and communication technology in Korean SMEs business organisations. The researchers categorise the factors that affect the adoption of technology into four groups: technology, organisational environment, business and government related factors. As far as the technology factor is concerned they found that cost of the technology, maintenance and training, and fear factor (security, technology). The researchers found that even the companies are using the technology but the cost is still the crucial issue for them. The cost of the upgrade of the existing technology was also found to be a barrier for the technology adoption. As far as the technology maintenance is concern, the researchers highlighted that the technological knowledge of employees and their management capacity can be a barrier to the adoption and extension of the information systems. The researchers also highlighted the point that company's fear of the leakage of company information, such as the transaction and the accounting information, can be a critical barrier to indirectly or directly adopting and extending implementation of new ICT service applications. Due to fear of leak of the information researchers found that one company is unwilling to adopt the new technology in their business activities. The researchers indicated that one CEO thinks that the leak of its business information and marketing strategy can cause the weakened competitiveness against

rivals. Therefore, online commerce of specially designed quality products can be copied so that the competitiveness of on-line companies can be decreased. Another important point highlighted by researchers from their survey is that of the technology availability (hard to find solution & customization). This is a crucial barrier that directly influences the ICT adoption.

a. Complexity and difficulty of using the system

According to Paul (2008) complexity means the degree to which an innovation is perceived as being relatively difficult to understand and use. The perceived complexity of an innovation is negatively related to its rate of adoption. While Alam et al (2007) in their discussion to the complexity of the technology reported that previous studies on the adoption of innovations indicated that the adoptions of complex technologies require organizational personnel to possess sufficient technical competencies.

Since the rapid change in the development around the world the technology become very sophisticated and it needs well educated and skilled personnel to deal with it. The technical complexity has been highlighted by Kapurubandara and Lawson (2006), Walker and Peansupap (2004), Garson (2006), Rogers (1995), Looi (2004), as an important barrier to innovation. Rogers (1995) who presented the diffusion theory of innovation has indicated that one of the characteristics of the innovation is "complexity".

Billo et al (1996) indicated that the most important challenges that face the information technology in order to satisfy the modern manufacturing requirements in higher quality products at low cost and with shorter delivery are:

1. To specify standard data structures and functional requirements for common manufacturing information applications.
2. Challenge for the organizational structures of information technologists to evolve to a design-build team structure.
3. Challenge to develop software engineering tools that assess world class metrics of performance such as cost, quality, and cycle time.

Vinimya website (2010) in its web page (FAQs) has indicated that the most common problems facing the e-procurement systems are:

1. Limited user adoption, caused by
2. Complex and inconsistent user interfaces, exacerbated by

3. Missing catalogues, a problem whose resolution is inhibited by
4. Lack of supplier capability and/or cooperation, which in turn
5. Inhibits transaction volume through the e-procurement system

b. Compatibility of the technology

The compatibility of the software/hardware is a very important factor to do any I.T business. This point has been highlighted by Voronoff (2010). The incompatibility results from the incompatibility of the software with operating system of the computer. The operating system defined by the webopedia (2010) as:

"The most important program that runs on a computer. Every general-purpose computer must have an operating system to run other programs. Operating system performs basic tasks, such as recognizing input from the keyboard, sending output to the display screen, keeping track of files and directories on the disk, and controlling peripheral devices such as disk drives and printers". An example of an operating system is illustrated in Figure (2-9) below.

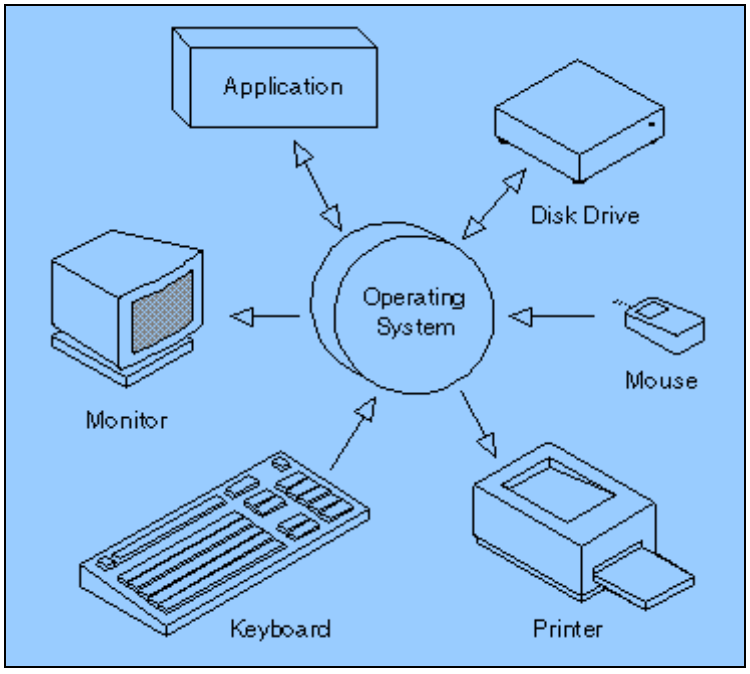


Figure (2-9): IT system components Webopedia (2010)

Sometimes it is difficult to transfer data/information from one application to another, Al-Qirmi (2006, 2007) Garson (2006). This means that it is difficult to import/export data between packages installed on the same or different computers. This is also depends on the operating system and its recognition of the input/output from different packages.

Rocco (2010) highlighted the compatibility of the software/hardware issues in businesses. He indicated that the computer hardware is basically all the physical peripherals such as the keyboard, CPU, mouse, modem and other parts required in assembling a computer and gets it working. While on the other hand business software are programs that will increase the efficiency of the business and reduce work time. He suggested that for IT companies and consultants, the process of choosing and purchasing the right Computer Hardware & Business software is an important one as it determines the smooth functioning and performance level of their systems and people. The configurations of the system, the software that can be loaded are some factors to be considered before taking a decision to close the deal.

Paul (2008) indicated that compatibility means the degree to which an innovation is perceived as being compatible with existing beliefs, experience and needs of potential adopters. A faster rate of adoption occurs when an adopter perceives an innovation as meeting the needs of the client.

c. Security of the information

This is also a problem arises from using the PCs or the Internet. Since there is a huge and rapid development in the field of "storage-kits" such as USB- flash, CD, DVD etc. The security issue becomes paramount in this case. This is related to the fact that many organisations think that "very sensitive data/information" could be copied by a USB or other devices and misused against that organisation. This point has been highlighted by Al-Solbi (2006) in his study on e-readiness in Saudi Arabia. The security of the internet is also very important and individual/organisations sometimes become hesitant to send sensitive information on the internet. In spite that there are many software programs to protect the internet users, but the hackers become very sophisticated in their methods to break the installed security systems to steal required information. Example of this a hacker from Wales-UK had broken the most sophisticated system in the world (i.e pentagon computer) system. The concern of the security issue has been highlighted by many researchers such as, Muller-Seitz et al (2009), Stockdale and Standing (2006).

Abell and Lim (1996) studied the benefits gained from using the internet in New Zealand organisations. They indicated that in spite of the acknowledged benefits gained from the Internet to expand their markets and perhaps even gain a completive advantage, they were

hampered by concerns over security, where target markets can be reached and problems with Internet Service Providers (ISPs). The study also highlighted security of both messages and internal networks were the main concerns of the companies surveyed. They also found that some of the companies indicated that they were dissatisfied with their Internet access. Unreliable connections, poor service and high charges were the main reasons given. That about a quarter of the original email requests for participation in this study failed to reach their destinations is further evidence of problems. The study also highlighted that the relatively young Internet service industry is facing a number of teething problems. The situation is likely to improve with time, especially given the increasing competition in the industry.

Lee and Kim (2004) also highlighted the issue of security of the information in Korean companies. Most companies fear that their information may be intercepted by their competitors. A study has been carried out by Tan and Eze (2008) in Malaysia SMEs on the adoption of the internet-based ICTs in their business found that the security is a barrier to the Internet adoption.

d. High cost of the system

The cost of the ICT system was also found to be a barrier to innovation. This has been highlighted by Antonia et al (2009), and Levratto, N. (2009). Lee and Kim (2004) in their survey to the Korean companies highlighted the cost issue. Most companies believe that the cost of the technology and the cost of upgrading the existing systems are too high.

The availability of financial resources in a company is vital factor which helps in adoption and diffusion of IT systems. Ismail et al (2009) conducted a survey among 323 Malaysian foodservice companies in Kuala Lumpur and Selangor. The results of multiple regression analysis revealed that sufficient capital and company affiliation factors related significantly to adoption of basic IT applications. However, only the sufficient capital factor affected the implementation of advance IT applications.

Another study has been carried out by Tan and Eze (2008) to examine the factors and adoption patterns of internet-based information and communication technologies (ICT) among Malaysian SMEs. A questionnaire methodology was used as a tool to collect data from 406 managers/owners in the southern region of Malaysia. The researchers found that internet-based ICTs adoption among SMEs provides new business opportunities and

knowledge. However, they found that security and high ICT cost continues to be barriers to internet- based ICTs adoption.

Dixon et al (2002) in their critical literature review to the SMEs in the UK, indicated that the use of the web by small businesses is still relatively underdeveloped. They indicated that the SMEs use the internet to send emails, transfer files or documents or gather information. However, they highlighted the point that many small businesses still do not own a computer and cost is still a major barrier for those companies with a turnover of less than £50000. The high cost of the technology is also highlighted by the united kingdom Federation for Small Businesses (2002) survey. The Federation survey found that nationally, costs remains the most important barrier to the new technology uptake.

e. Innovation cost difficult to control

Antonia et al (2009) indicated that one of the barriers facing the innovation in SMEs is related to difficulty of controlling cost of innovation. Since the innovation is anything new, therefore this is expected. This means that creating a new thing needs more resources and could exceed the allocated ones and therefore it is difficult to control.

Lee and Lim (2004) highlighted the high cost of outsourcing business activities in Korean business SMEs. Skoko et al (2006) in their study to the adoption of the ICT in Australian SMEs indicated that for a company to adopt ICT the costs are not just related to the hardware and software costs, but also to the employees and organisational changes that are taken in order to make ICT effective in their workplace. They indicated that the complementary investment usually cost much more than the initial ICT investment itself. It can be concluded that the cost of ICT adoption is difficult to control since it involves many sources of costs such as Hardware/software costs, creating and ICT environment and preparing the employees to the new environment. Training programmes need to be put in place to support the utilisation of the new technologies by the staff in their daily activities.

f. Technical, societal and inter-organisational barriers

Technical, societal and inter-organisational barriers would include the risk of employing technology which could be out-of-date after a short period and would need replacing earlier than expected. (Starbuck, 1996). This is particularly relevant in fields such as IT. Societal factors would include the norms and values that a particular society hold and their attitude

towards socio-economic change Shane (1995). External barriers may be present at the inter-organisation level where firms have to co-operate at regional, national or international level (Tidd et al., 1997). This is often a case of problems in the supply and distribution chain where for example a new firm might have difficulty in accessing an existing chain.

Shavinina (2003) indicated that the risk of technology obsolescence, destruction of firm's competence with change in technology and danger of picking the wrong technology is one of the barriers face the innovation. Shavinina (2003) also highlighted the scale of capital required to adopt the new technology and scale of experience required for the new technology as factors affect the new technology adoption. Shavinina (2003) also highlighted the importance of the societal factors may form barriers to innovation. Norms and values of society and attitudes towards science, socio-economic change and entrepreneurship determine the climate of innovation, and if the latter is negative it will have an adverse effect on innovation efforts and on the willingness of the government to assist the innovation , Shavinina (2003).

2.4.1.2 Management characteristics

Management generally related to people, structure and strategy of the organisation. People related barriers would include both individuals and groups within an organisation and are related to attitudes and perceptions towards innovation. There may well be conflict between personal and organisational goals where for example the introduction of new practices may render the experts knowledge obsolete. Such resistance to innovation would necessitate a so-called "innovation champion" whose role is crucial in persuading the dissenters (Gemuenden (1988) and Hauschildt (2003)). An innovation champion according to Markham and Aiman Smith, (2001) is someone who recognises the potential of an innovation and strongly and actively promotes its adoption.

Structural related barriers include lack of clear communication between different departments in a company, inflexible hierarchical organisations and lack of time for task delegation and organisation of work (Hadjimanolis (1999), Amabile (1997)). Amabile (1997) observed that the work environment has a direct impact on the intrinsic motivation for creativity and innovation and an adverse environment may hamper innovation efforts.

Strategy related barriers include goal and resource related barriers. This category may have the most impact on the innovation of adopting IT to the Libyan construction industry as it covers lack of equipment as well as staff's inadequate experience or knowledge or inability to recognise the benefits of new technology to enable organisations to grow in what is becoming an increasingly competitive market place. Other resource-related problems arise from lack of internal funds (cash-flow) and failure to establish "in-house" Research and Development facilities. A survey related to the barriers to effective innovation in 550 large companies in USA has been carried out by Loewe and Dominiquini (2006). The researchers have ten years experience in helping developing core competence in innovation in US companies. They diagnosed six categories of barriers across industries as follows:

1. Short-term focus
2. Lack of time, resources or staff
3. Leadership expects payoff sooner than is realistic
4. Management incentive are not structured to reward innovation
5. Lack of systematic innovation process
6. Belief that innovation is inherently risky

The researchers suggested that in order to create an innovative environment four areas should be considered. These areas are: leadership & organisation, processes & tools, people and skills, and culture & values. The important point, which has been highlighted by the researchers, is that in order to create an innovation environment in an organisation the four areas should be considered and given attention. They stated that 'without a systematic attack in all four areas, your innovation efforts are likely to fail – or at best to produce a one-time gain that won't be repeated'.

The managerial barriers related to the people, strategy and structure are explained below.

a. Resistance of manager/owner to change

Resistance of manager/owner to change and adopt new technology is an important barrier faceing the adoption and diffusion of ICT system. Levratto (2009) in his discussion to the innovation barriers in French SMEs , highlighted that one of the barriers to innovation is related to resistance to change in the Firm "rigid organisation"

Skoko et al (2006) in their study to the adoption of the ICT in Australian SMEs highlighted the importance of the employees and the managers' characteristics in ICT adoption. They indicated that the employees and managers are crucial to take into account since individuals

use ICT for their everyday work and know best how ICT influence them and processes in the company.

According to e Kotelnikov (2011) most people don't like change because they don't like being changed. When change comes into view, fear and resistance to change follow – often despite its obvious benefits.

People fight against change because they:

1. Fear to lose something they value, or
2. Don't understand the change and its implications, or
3. Don't think that the change makes sense, or
4. Find it difficult to cope with either the level or pace of the change.

An interesting point has been highlighted by Ajayi (2003) related to the businesses organisations in developing countries. He highlighted the point that in most businesses organisations in the developing countries the chain of command based on the hierarchical system of command comes from the top management to the low level of management and this affect the e-commerce adoption. In this situation if the individual (owner/top manager) who has the authority feels that e-ecommerce is not suitable for business, he/she will rather not adopt it. However, the UNCTAD (2004) highlighted the importance of the top management involvement in the organisations businesses in developed countries and indicated that this involvement is turning point the work of the organisations.

b. Lack of education of owner/manager

The lack of education of the manager/owner of the SMEs has a negative impact on the adoption and diffusion of the ICT systems in SMEs. A study carried out by Mostafa (2005) on the creativity and innovativeness in Egyptian organisations has found that greater the education of manager, the more he/she is likely to adopt creative and innovative activities. The importance of the educational level of manager is also highlighted by Oladapo (2007) in his study to the innovation in Nigerian construction industry. The educational background of managers/owners is also highlighted by Fichman and Kemere (1997) as a key factor in IT adoption.

Song and Ma (2010) presented an interested paper to the international conference on the technology held in China. Their aim was to explore the relationship between the

characteristics of the technology, media and telecommunications (TMT) and the technological innovation in resource-based listed companies. Their results show that there is significant positive relationship between top managers' tenure and technological innovation (R & D input intensity); education and specialty and occupational background of top managers have significant effect on technological innovation.

An interesting study has been carried out by Hung and Lo (2010) in Taiwan industry. The study was aimed to study the relationship among business performance, CEO background and CEO ownership. The independent variables considered in this study are: age, degree, education background, stock ownership, CEO/chairman nationality duality, and foreign degree. While the dependents variables are financial indicators such as RoI (Return on Investment), RoE, (Return on Equity), RoA (Return on Assets), and EPS (Earning Per Share). These are economical indicators defined by Investowords.com (2011a); and Investowords.com (2011b) as follows:

RoI (Return on Investment), 'which is a performance measure used to evaluate the efficiency of a business investment or to compare a business efficiency to different others efficiencies' Investopedia.com (2011a).

RoE, (Return on Equity), (which is a measure of how well a company used reinvested earnings to generate additional earnings, equal to a fiscal year's after-tax income, (after preferred stock dividends but before common stock dividends) divided by book value, expressed as a percentage. (It measures the efficiency of the company)), Investowords.com (2011a)

RoA (Return on Assets), (which is an indicator of how profitable a company is relative to its total assets. RoA gives an idea as to how efficient management is at using its assets to generate earnings. Calculated by dividing a company's annual earnings by its total assets, RoA is displayed as a percentage. Sometimes this is referred to as "return on investment'); Investopedia.com (2011b)

EPS (Earning Per Share), (which is Total earnings divided by the number of shares outstanding. Companies often use a weighted average of shares outstanding over the reporting term. EPS can be calculated for the previous year ("trailing EPS"), for the current

year ("current EPS"), or for the coming year ("forward EPS"). Note that last year's EPS would be actual, while current year and forward year EPS would be estimates, Investowords.com (2011b).

The results of the study are shown in Table (2-11) below.

Table (2-11): Relationship between Independent Variables and Dependent Variables

		EPS	RoE	RoI	RoA
Age		Negative	Negative	Negative	Negative
Degree			Negative	Negative	Negative
Educational Background	Engineering.				
	Science		Yes		Yes
	Business				
	Double		Yes	Yes	
Ownership			+	+	+
Chairman/CEO		-	Negative	Negative	Negative
Foreign Degree					

Source: Hung and Lo (2010)

As far as the degree is concerned the study found the study found that the degree of managers is negatively related to RoE, RoI and RoA. It hints that managers with higher degree achieve worse performance in RoE, RoI, and RoA than managers with lower degree. The degree of managers is insignificant correlated to EPS. The study also figured that managers with two educational backgrounds emphasize RoE, and RoI; managers with science background focus on RoE and RoA. This research uncovered that foreign degree is insignificantly related to business performance indicators. In addition, this study also found out that managers with two educational backgrounds emphasize RoE and RoI; and managers with science background focus on RoE and RoA

The research also revealed that the ownership of managers is positively related to RoE, RoI and RoA. That means increasing ownership of managers will enhance better performance on RoE, RoI and RoA. Then, the ownership of managers is insignificant correlated to EPS. Nevertheless the study found that chairman/CEO duality is negatively related to EPS, RoE, RoI, and RoA. It hints that CEOs who also are elected as the chairman of board achieve worse performance on EPS, RoE, RoI, and RoA than CEOs without dual position.

c. Lack of commitment of managers towards their organisations

The commitment of managers to their SMEs is a vital factor in promoting the adoption and diffusion of the ICT. Mostafa (2005) in his study on creativity and innovation in Egyptians SMEs found that lack of commitment, support and risk aversion and rigidity of rules are the most important barriers facing the Egyptian SMEs. The researcher found that risk aversion by the managers to be one of the major creativity barriers. This means that the managers were found to be hesitant in risk taking to encourage creativity and innovation in their organisations.

People-related barriers according to Witte (1973) may be due to either lack of will or lack of competence and such barriers occur in both managerial and non-managerial staff. Will-related attitudes such as jealousies and resentments for example exert a detrimental effect upon innovation as do competence-related problems which could stem from a lack of creativity caused by lack of training and motivation.

Brewer and Runeson (2009) highlighted the impact of the decisions makers on the innovation of the technology in Australia construction industry. They found that the adoption of innovative ICT-driven business practices by a firm is determined in large part by the attitude of the decision maker, which changes over time, in response to technological push and cultural pull. Moreover, attitudes can be mapped against three exogenous issues: human, business process and technological. At the heart of these lies a domain of endogenous issues that are personal and, therefore, unique to the individual decision maker. All of these issues have an intra-firm and inter-organisational dimension, and these vary in response to the context within which they are considered.

Lee and Kim (2004) in their survey to the barriers and drivers affecting the Korean company's adoption of the ICT found that the organizational environment plays an important part in the adoption and innovation of the ICT systems. The organizational related factors include the management awareness (the study estimates the awareness by using the intention of ICT adoption and of business extension via ICT). The awareness was found to be positive which indicates that the companies are aware of the importance of the new technology to their business. The second factor which was found in the survey is the perceived benefits gains from the utilisation of the new technology. The study revealed that most companies realised the benefits which could be achieved from using the new technology.

d. Style of manager

The top management i.e. (such chief executive, Directors etc) have vital roles in achieving the goals set by the organisations. The vision of the leadership is very important in paving the way forward. The leadership in any organisation can motivate people toward their jobs and create positive outcomes from their contribution in organisation business. The main responsibility of the leadership is the creation of a clear strategy from which the organisation's employees can get a vision about their organisation future.

The leadership of an organisation is usually responsible for creating a clear strategy, which leads to achievable benefits for its organisation. As far as the ICT system is concerned the business strategy usually includes business strategy for the ICT system, its budget, required resources, risks analysis, time scale to execute the strategy, etc.

Russell and Hoag (2004) have discussed the impact of people on the implementation of an information technology IT in an organisation. They indicated that understanding people and how they factor into complex information technology (IT) implementation is critical to reversing the growing trend of costly IT implementation failures. They also indicate that there are organisational factors. These factors include user's perceptions of innovation, the firm's culture, the types of communication channels used to diffuse knowledge of the innovation and leadership factors. This means that the social factor is a very important issue, which should be considered by any organisation in order to achieve useful benefits from its ICT system.

Shiels et al (2003) have examined the business practices of 24 (Small Medium Enterprises) SMEs and the adoption of Internet technology on both the existing potential customers. They found that the characteristics of the firm and industry sector are contributory factors to the extent of adoption and exploitation of ICTs by SMEs to support business process.

Auramo et al (2005) have discussed the benefits of the utilising IT in supply chain management (SCM) and found that the benefits of the IT in SCM are:

1. Focused e-business solutions to serve their customers.
2. Improve business efficiency
3. Improve quality of information
4. Improved agility of the supply network

5. To gain strategic benefits, the use of IT has to be coupled with process redesign.

Abraham (2003) has discussed the critical success factors for the construction industry and suggested that these factors are as follows:

1. Structure of industry- such as the interactions, relationships, and operational characteristics.
2. Competitive strategy-to establish unique positioning
3. Market conditions-analysis of the marketplace
4. Political environment- impact of politics on decisions making etc.
5. Organisational structure-the form of the internal administrative structure of the organisation.
6. Technical applications-the use of technical applications for advancement of the company.
7. Employee enhancements- the life long learning process for employees tied to personal, professional, and cultural growth.

Process benchmarking- identifications of processes and procedures and their continual

The authoritative manager's style, which is usually based mainly on instructions to subordinates without input from the subordinates, was also found to be a common practice in the surveyed organisations, Mostafa (2005). This style of management is considered by Weatley (1999) to give negative impact on the creativity and innovation. The rules and the regulations were also found to have negative impact on the creativity and innovation. The researcher didn't study the influence of culture on the innovation in the Egyptian organisations. However, he suggested that the culture is an important factor and a study should be carried out to find the impact of culture on the creativity and innovation. Tiwari and Buse (2007) have also indicated that bureaucratic management is a barrier to innovation.

Capozzi (2010) indicated that leaders and organisation culture are important factors in organisational adoption and utilisation of innovation. Capozzi (2010:p. 25) in her special report, adapted from a survey carried out by The McKinsey Quarterly (2007) related to the leaders and innovation stated that "Development organization leaders can draw upon the experiences of their private sector peers on successful practices that capture the full potential of innovation as well as how to battle common tensions and challenges, which aren't all that unique to the private sector. Leading strategic thinkers across sectors are moving beyond a

narrow definition of innovation to pioneer innovations in not just products but also services, consumer experiences, operational processes, distribution, value chains, policies, business models, and even the functions of management and how people work".

Gumusluoglu and Ilsev (2009) discussed the transformational leadership and organisation innovation and emphasised that leadership is an important factor affecting innovation and it is positively influencing organisational innovation. The researchers collected data from 163 R&D employees and managers of 43 micro- and small-sized Turkish entrepreneurial software development companies. They found from the analysis of their results that there is a positive influence of transformational leadership on organizational innovation. In addition, external support for innovation was found to significantly moderate this effect. Specifically, the relationship between transformational leadership and organizational innovation was stronger when external support was at high levels than when there was no external support. The moderating effect of internal support for innovation, however, was not significant. This study shows that transformational leadership is an important determinant of organizational innovation and encourages managers to engage in transformational leadership behaviours in order to promote organizational innovation. In line with this, transformational leadership which is heavily suggested to be a subject of management training and development in developed countries should also be incorporated into such programs in developing countries. Moreover, this study highlights the importance of external support in the organizational innovation process. The results suggest that technical and financial support received from outside the organization can be a more important contextual influence in boosting up innovation than an innovation-supporting internal climate.

Barker (2001) studied how the secondary school head teachers contribute to the effectiveness of their schools. He found from his field study that despite the complications of social context, internal politics and external pressure, strong heads seem to adopt similar, well-balanced leadership styles and strategies that correlate with well-motivated students and staff. He also found that, in contrast, poor performances operate a limited range of styles and strategies and elicit a negative response from their colleagues.

It can be concluded from the above that the leadership is any organisation is an important factor in promoting the adoption of new ideas, methods, procedures and technologies which hep in improving of their organisations performance.

Lever (2008) has compared the effective leadership with poor leadership. He highlighted the fact that effective leadership ensures the business has selected good business strategies, creates plans with depth to planning analysis, a well designed business organisation, efficiently operated and managed for continuous improvement. On the other hand the researcher found that the poor leadership didn't follow the above points. He indicated that the characteristic of the poor leadership are as follows:

1. Gather insufficient external and internal information for strategy and planning
2. Wrong people involved in setting strategies and direction
3. Lack of depth of thinking to generate good strategies and plans

e. Age of the owner/manager

The age of the manager/owner was also found to have an impact on the adoption and diffusion of ICT in SMEs. Hunter and Kemp (2004) found that younger ages of investors are more open and had positive attitudes toward adopting e-commerce. This is expected since the young people who used the new technologies in their childhood are more familiar with it than the older people. While Abbasi and Al-Mharmah (2003) in their discussion to the project management practice in Jordan found that the old management (managers) have negative approach toward the utilisation of the new technologies in Jordan organisations.

Many researchers such as Daly and Kitchell (1995), Taylor (1975), Hambrick and Mason (1984), Burke and Light (1981) identified that there is a negative relationship between manager's age and innovation adoption. Daly and Kitchell (1995) and Burke and Light (1981) indicated that age and innovation adoption have consistently identified a negative association commonly attributed to lifestyle, declining cognitive capabilities and energy levels.

Burke and Light (1981) indicated that certain learning abilities such as memory decline with age; Taylor (1975) highlighted an important point, is that the older managers are also less able to evaluate new ideas quickly and integrate them effectively in decision making.

While Hambrick and Mason (1984) indicated that the older managers are less recently educated; they are also less likely to be computer literate. The researchers also pointed out that the older managers also lack the stamina to endure the constant stresses and strains of technological change. They are therefore, often more reluctant to take risks or venture into

new endeavour. On the other hand younger managers are more likely to have greater learning capabilities, more recent education and be more flexible and risk taking.

Hung and Lo (2010) in their study of the ICT applications in Taiwan industry found that the age of managers is negatively related to the ICT usage in Taiwan industry. They indicated that the elder managers achieve worse performance in ICT use compared to the younger managers.

Awamleh (1994) carried out a field study on 293 managers in civil service in Jordanian organisations. His aim was to examine the relationship between managerial innovation (dependent variable) and sex, age, education, organisational level, and length of service as dependent variables. He found that there is a negative yet weak relationship between innovation and age, organisational level, and length of service. However, there is a positive yet weak relationship between innovation and education and sex.
Song and Ma (2010) studied 91 Chinese companies and found that the impact of age and educational level on technological innovation is not significant.

A study has been carried out by Hung and Lo (2010) on SMEs in Taiwan industry and found that the age of managers is negatively related to EPS, ROE, ROI, and ROA. It hints that elder managers achieve worse performance in EPS, ROE, ROI and ROA than younger managers. The results are shown in Table (2-7) mentioned above.

f. Lack of motivations and incentives schemes

Lack of intensive schemes to encourage people to use the technology has also been found to be a barrier to innovation. The SMEs should create an environment to encourage their employees to use the ICT systems in their organisations. Reward schemes should be utilised to encourage the employees to use the ICT systems, such as letters of thanks and recognition to their efforts in this important area. This point has been highlighted by Loewe and Dominiquini (2006) in their study to the USA organisations. They indicated that management incentive is not structured to reward innovation.

A study carried out by Lyanda and Ojo (2008) on impact of the motivation, influences, and perceived effect of the ICT adoption in Botswana organisations found that ICT application in Botswana was still at an elementary stage, mainly communications and record keeping. In

terms of motivation and influence, the competitive motive and internal sources of information and influence were dominant and that the overall effect of ICT adoption on several organizational activities was moderately positive.

An interesting study has been carried out by Jun and Weare (2006) on the institutional motivation on the adoption of the e-government in the united state of America. The study found that externally oriented motivations appear more influential than the internal factors such as bureaucratic policies. This suggests that the external motivations may make local governments more responsive to external constituencies if barriers to change may be overcome.

In general it can be said that motivations are important factor to encourage the adoption of the new technologies.

g. Lack of finance

Availability of money for any an organisation is a very important factor to keep it going and to expand its activities. The importance of this factor has been highlighted by many researchers such as Levratto (2009), Drury (2005), Wicker (2001), Aubert (2004), Kapurubandara and Lawson (2006), and Oak (2007).

An interesting report prepared by Austrian Institute of Economic Research (WIFO), and Fraunhofer Institut für System- und Innovationsforschung (ISI), European Commission Directorate-General Enterprise Unit D1 Innovation Policy Development (2010) related to the drivers and barriers to innovation in European countries indicated that lack of finance is a very important factor affecting the innovation in Europe. The report stated that 'the perception of financial barriers to innovation is heavily related to the general institutional framework conditions. Firms in industries that are heavily dependent on external finance are more likely to experience financial barriers to innovation in countries with less developed financial systems. Our results show that smaller firms are financially more constrained especially in the economically most advanced EU member states'. This report reflected the lack of finance is an important barrier to innovation in European countries.

Ilesanmi (2007) in his studies to the Nigerian SMEs found that the main reasons for not adopting e-commerce in Nigeria are as follows, Ilesanmi A. (2007, p.64).

- Lack of fund

- Lack of IT skills for developing e-commerce
- Lack of necessary infrastructures
- Not necessary for business
- Others

These reasons have been arranged according to their importance. It can be seen that lack of fund is on the top of this list.

h. Lack of information about technologies

Many managerial bosses in SMEs do not have enough information about the innovation and the new technologies and this is considered to be a barrier by many researchers such as Tiwari and Buse (2007), Mohnen and Rosa (1999), Levratto (2009 and Zwick (2002).

Tiwari and Buse (2007) and Mohnen and Rosa (1999) indicated that "lack of knowledge on how to manage innovation" is barrier to innovation. While Levratto (2009) and Zwick (2002) indicated that lack on information on technology and lack of information on markets are barriers to innovation.

Lee and Kim (2004) indicated that Korean companies obtained their information about the technology through several channels such as acquaintance, customers, the internet and the newspapers.

2.4.1.3 Employees characteristics

There are barriers arise from the employees. These barriers are related to the lack of skills and experiences and attitudes toward innovation. It includes lack of skills and experience, employees' attitudes towards innovation, and cultural factors. These issues are discussed below.

a. Lack of skills and experience

Lack of experience in new technology is a very important barrier to innovation. Since the rapid change in the development in the technological world around us it is important to develop ourselves to face the new technological challenges. Lack of skills and experience of employees has been highlighted by many researchers such as Aubert, Jean-Eric (2004), Oak (2007), Levratto, N. (2009) and Wicker (2001). Training and development programmes should be used to develop the skills of the employees.

An interesting study has been carried out by Ilesanmi (2007 on the barriers that face the e-commerce in Nigerian SMEs is the lack of skilled workforce. Ilesanmi (2007, p29) stated that:

"In developing countries, lack of technical knowledge and specialized know-how are obvious barriers which prevent businesses from implementing e-commerce systems. SMEs that intend and want to reach new clients in the business-to-consumer field have to undertake extensive marketing efforts and build a relatively good website. The low personnel of network and internet specialists in the labour market only make this difficult for SMEs to achieve as these are rampant problems to both internal and external to these organizations".

He found that the main internal barriers that face the e-business in Nigeria as follows:

1. Employees lack required skills
2. The company lacks skills
3. Lack of funding of internal projects
4. Lack of time to imitate the project
5. E-commerce not suited for products and services
6. E-commerce not suited to the condition of business
7. e-commerce not suited for our customers
8. Security concern of payment on the internet

b. Employees attitudes toward innovation

The attitude of employees toward the innovation is a very important factor in fostering the adopting and diffusion of an innovation in SMEs. An interesting paper on the creativity and innovativeness in Egyptian organisations has been presented by Mostafa (2005). Questionnaire methodology was used to investigate the perceived creativity and innovativeness from 170 Egyptian business managers. The study has found that statistical significant difference in attitudes towards organisational creativity based on the managers' functional areas in organisations. The study has also revealed that the greater the education of manager, the more he/she is likely to adopt creative and innovative activities. The resistance of employees to innovation also has been highlighted by Antonia et al (2009) in Spanish SMEs. Incentives schemes are essential to motivate employees to learn and use the new technologies.

Elias et al (2010) has studied the attitudes of the employees towards the technology in the workplace. They found that such attitudes have been linked to such important issues as the

successful implementation of new technologies in the workplace, employee intent to use technology, and the actual usage of technology by employees. They examined the relationship between the age of 612 employees and the employees' attitudes towards technology. In their study they examined as a moderator of 612 employees' attitudes towards technology in relation to work motivation (intrinsic and extrinsic) and overall job satisfaction. In their analysis they used hierarchical moderated multiple regression and found that age moderates the relationship between attitude toward technology and intrinsic motivation, extrinsic motivation, and to a lesser extent, overall job satisfaction. They found that the older employees exhibit the weakest relationships when possessing a low attitude towards technology. Their results highlighted the role of age as a moderator of the employee's attitudes towards the technology.

2.4.1.4 Organisation characteristics

This section includes the organisation characteristics such as organisation size, organisation age, type of organisation and type and organisational slacks. These factors were found in the literature to have significant impact on the innovation and adoption of IT in the organisations. These factors are discussed below.

a. Organisation size

In his discussion to effect of the organization size on innovation, Damanpour (1992) found from his 36 correlations of 20 published studies that there is a positive relationship between the organization size and the innovation. In addition he also highlighted the effect of the moderating factors indicate that:

- Size is more positively related to innovation in manufacturing and profit- making organizations than in service and non-profit-making organizations;

- The association between size and innovation is stronger when a non-personnel or a log transformation measure of size is used, than when a personnel or a raw measure of size is used;

- Types of innovation do not have a considerable moderating effect on the relationship between size and innovation; and

- Size is more strongly related to the implementation than to the initiation of innovations in organizations

However, Lee and Xia (2006) have indicated that the relationship between the organisational size and the innovation has been considered to be an important factor in predicting the IT adoption. However, in their meta-analysis of 21 empirical studies found that the relationship between the organisation size and IT adoption is disturbingly mixed and inconsistent. They carried out 54 correlations derived from 21 empirical studies to examine the relationships between the size and IT adoption and also to examine the effect of six moderators on relationship between the size and IT adoption. They indicated that although the results show a positive relationship generally existed between the size and IT adoption, the relationship was found to be moderated by five variables: type of IT innovation, type of organisation, stage of adoption, scope of size, and type of size measure. They indicated that the mixed views about the relationship between the size and innovation can be explained by a lack of consideration of moderators.

Yao et al (2002) also studied the relationship between the organisational size and innovation. They examined the Asynchronous Transfer Mode (ATM) technology adoption in university settings to investigate if there is a statistically significant relationship between university size and ATM technology adoption. They found that that there is significant evidence that there is a statistically significant relationship between university size and ATM technology adoption in university settings. They suggested that the organisational size can be served as a predictor of IT adoptions in other organisations.

It can be concluded from the above studies that there is a relationship between organization size and the innovation.

b. Organisation age

The availability of financial resources in a company is vital factor which helps in adoption and diffusion of IT systems. Ismail et al (2009) conducted a survey among 323 Malaysian foodservice companies in Kuala Lumpur and Selangor. The results of multiple regression analysis revealed that sufficient capital and company affiliation factors related significantly to adoption of basic IT applications. However, only the sufficient capital factor affected the implementation of advance IT applications.

Researchers such as Flanagin, (2000) Kimberly and Evanisko (1981), Murphy and Tan (2003), Nguyen, et al (2003) suggest that the relationship between the organisation age and the innovation adoption is negative.

It has been pointed out by Flanagin (2000); Kimberly and Evanisko, (1981) that younger organizations tend to adopt innovations faster compared to older organizations. With regard to implementation and adoption, respectively.

A study in Singapore carried out by Murphy and Tan (2003) found that younger travel agencies were more responsive to their e-mail queries and more likely to use branded e-mail addresses compared to the older travel agencies.

However, Ismail et al (2009) studied the IT adoption in Malaysia food industry found a positive relationship between the company age and its IT adoption. Their study suggests that the older company, the more they accept the innovation. They didn't expect this result (they expected negative relationship), and made their comments that it a phenomenon in foodservice industry that merits in depth investigation.

c. Type of business

Eunju et al (2008) carried out research on 103 US apparel manufactures aimed to explore the impact of business type upon adoption process of quick response (QR) technologies in the apparel industry. They found that business type to impact significantly the firms' perceptions of benefits to be derived from the (QR). The perceptions of these benefits, in turn, affected the apparel manufactures' adoption of a QR strategy which, in turn, influenced their use of various QR technologies.

2.4.2 External barriers

The external barriers are those which the organization has no control and they originate from the environment in which the organization finds itself. The environment could refer to the market in general or to levels of administration ranging from local to central government. Market-related barriers would include, for example, insufficient research and development, miscalculation of supply and demand and short-terminism. The latter is described by Storey (2000) as the pressure on public-quoted companies to deliver profits in the short term. By their very nature innovatory projects generally need longer than the short term to be

developed and since few lenders are unwilling to sacrifice short-term returns for longer term gains, finance is more difficult to obtain for such projects. Moreover innovation is more risky than established products.

A research has been carried out by Alinaitwe et al (2007) aimed to identify and rank the main innovation enablers and barriers in construction industry in Uganda. A questionnaire methodology was used to investigate the views of the contractors of major construction industry in the country. The main barriers to the innovation in Uganda construction industry were found to be: size of the market, level of security, level of government interference and management, level of government tax on new products processes and services, Lack of access to international markets, and policies that discourage of labour movement.
In order to simplify the discussion of the external barriers to innovation the researcher has decided to divide them into lack of government regulations, lack of government/external financial support, unpredicted macro economy, lack of national /international standards, lack of national ICT strategy, tax regime, lack of students studying engineering sciences, lack of intellectual property rights, lack of cooperation with business partners, and brain drain.

2.4.2.1 Lack of government regulations

Lack of government regulation has been found by researchers to be barriers to innovation. Researchers such as Al-Solbi (2006), Wicker (2001), Al-Hyari (2009) , Aubert (2004) and Levratto (2009) highlighted this issue. For example, in e-marketing, government regulations are vital to protect the rights of both the buyer and the seller. Lee and Kim (2004) in their study to the Korean companies had highlighted this point.

Shavinina (2003) has discussed the governmental policies and regulations impact on the innovation in SMEs and emphasised that these frequently considered as source of barriers. He indicated that many policies directly and indirectly related to innovation are designed to correct market failure. Problems may arise, however, due to unintended consequences of such as policies and side effect of regulations. He added that standard imposed by government or by supra-national organisations such as the European Union, may also act as obstacles to innovation. Nevertheless, bureaucratic procedures in getting licences or grants and other contacts with governmental organisations are also a frequent cause of barriers.

Shavinina (2003) also highlighted an important point which is related to the discriminated policies carried out b the government in its support towards the micro, small and large organisations. This will have a negative impact on the innovation and adoption of ICT by organisations. Laws and regulations may give rise to barriers due to either their side effects or inadequate in implementation. Legal constraints include labour and costumer protection regulations, environmental regulations, lack of suitable institution, inadequate performance of existing ones are also considered as barriers, Shavinina (2003).

2.4.2.2 Lack of government/external financial support

Lack of government/external body financial support to the SMEs is also been found as a barrier to innovation in SMEs. This issue has been highlighted by many researchers such as Aubert, Jean-Eric (2004) and Tiwari and Buse (2007).

The point of government financial support to the Korean business to adopt ICT in their activities has been acknowledged by Lee and Kim (2004). They found in their study that in spite that the Korean government subsidised the ICT consortiums and cooperated with the SMEs which have a great deal of SMEs have adopted the ICT service platforms, the Korean companies asked for more assistance from the government in three areas: the support of the standardisation and the development of ICT platforms, supporting training programs and loan and fund financing.

2.4.2.3 Unpredicted macro economy

Unpredicted macro economy is also found to be an external barrier. The credit crunch and the fluctuated money markets is a worrying factor for the business SMEs. This factor has been highlighted by many researcher such as Al-Solbi (2006), Katila, R., and S. Shane (2005). Gordillo, M., and P. Herrmann (2005) and Antonia et al (2009).
The unpredicted fluctuation of the macro economic has an impact on the innovation.

The Organisation for Economic Co-operation Development report on science, technology and innovation in the new economy, OECD (2000) highlighted this influence. The report stated that “scientific advances and technological change are important drivers of recent economic performance. The ability to create, distribute and exploit knowledge has become a major source of competitive advantage, wealth creation and improvements in the quality of life. Some of the main features of this transformation are the growing impact of information and communications technologies (ICT) on the economy and on society; the rapid application of

recent scientific advances in new products and processes; a high rate of innovation across OECD countries; a shift to more knowledge-intensive industries and services; and rising skill requirements. These changes imply that science, technology and innovation are now key to improving economic performance and social well-being. However, if governments want to obtain the benefits from this transformation they will have to put the right policies in place. Limits on public spending, increased competition and globalisation, changes in the drivers of the innovation process, and a better understanding of the role played by science and technology in economic performance and societal change, have led governments to sharpen their policy tools", OECD (2000, p1).

2.4.2.4 Lack of national / International standards

Lack of national standard on how to deal with innovation is also found to be barrier to innovation. This factor has been highlighted by Levratto (2009) in his discussion to the barriers in French SMEs.

An interesting UK innovation survey has been carried out by the department of trade and industry (DTI) /office of national statistics during the years 1998-2000 to the British organizations related. The selected sample was 19000 firms of the total of 127000 firms. The results of the survey were published by Mercer and Robson (2004) from department of trade and industry. The results show that 8,172 businesses responded to the survey, giving a response rate of 43%. The survey found that the main barriers facing British organizations SMEs and large organizations as shown below.

1. Direct costs of innovation too high
2. Finance
3. Impact of regulations or standards
4. Availability of finance
5. Excessive perceived economic risk
6. Lack of qualified personnel
7. Lack of customer responsiveness to new goods or services
8. Lack of information on markets
9. Organisational rigidities within the enterprise
10. Lack of information on technology

The above factors organised according to their importance. It can be seen from the list that the barrier regulations and standards ranked in the third rank in the list by the respondents. This highlighted the importance of this barrier.

Another survey on the innovation carried out on the British enterprises by the department of business innovation and skills (BIS) (2009). The survey sample included 4000 firms. The main constraints to the innovation found in the survey are summarized in Table (2-12) below. The obtained results from the survey classified the organizations as 'active in innovation' and 'non-active innovation' organizations as shown in Tables (2-12) and (2-13) respectively.
It can be seen from Table (2-12) and (2-13) that the cost factor is not important for the 'innovative-active firs' as it is for 'non-innovative-active firms'. The reason is related to fact that the non-innovative-active firms haven't tried the innovation and blame the cost for the cost of their non-innovation activities. This also explained the differences in other factors between the innovative and non-innovative firms. Table (2-12) shows the percentage of the active firms and their assessment to different factors of constraints. These constraints are related to the cost factors, knowledge factors, market factors, and regulatory factors. The rating was not important, low, medium and high importance. Table (2-13) shows the responses of non active firms in using the IT systems. The responses of both active and non active firms to the same questions are shown in Tables (2-12) and (2-13) below.

Table (2-12): Innovation constraints (percentage of innovation active firms)

	Constraint	**Not important**	**Low**	**Medium**	**High**
Cost factors	Excessive perceived economic risks	26.2	20.2	27.6	20.3
	Direct innovation cost too high	29.4	18.1	25.8	21.1
	Cost of finance	27.6	22.7	22.2	22.3
	Availability of finance	29.8	25.5	19.0	20.4
Knowledge factors	Lack of qualified personnel	32.1	31.8	22.5	8.4
	Lack of information on technology	36.2	39.9	15.5	3.3
	Lack of information on markets	35.9	38.9	16.2	3.3
Market factors	Market dominated by established businesses	33.5	30.7	20.1	10.4
	Uncertain demand for innovative goods or services	32.4	28.5	24.5	9.1
Regulatory Factors	UK Government regulations	41.3	29.1	13.5	10.4
	EU regulations	46.2	28.3	10.9	8.8

Source: BIS (2009, p.39)

Table (2-13): Innovation constraints (percentage of non-innovation active firms)

	Constraint	Not important	Low	Medium	High
Cost factors	Excessive perceived economic risks	61.3	8.1	9.8	8.9
	Direct innovation cost too high	62.9	7.2	7.9	9.9
	Cost of finance	61.0	8.4	8.9	10.1
	Availability of finance	61.3	9.7	8.0	9.3
Knowledge factors	Lack of qualified personnel	64.0	12.5	7.2	4.3
	Lack of information on technology	66.2	13.6	6.0	2.3
	Lack of information on markets	66.7	13.6	5.5	2.0
Market factors	Market dominated by established businesses	62.5	10.5	8.5	6.4
	Uncertain demand for innovative goods or services	63.7	9.6	8.9	5.8
Regulatory Factors	UK Government regulations	67.2	11.2	5.1	4.5
	EU regulations	69.4	10.3	4.7	3.5

Source: BIS survey (2009, p.40)

It can be seen that the regulations (both UK government and European regulations=which includes standards) are also considered important in BIS survey 2009 as shown in Table (2-12) and 2-13) mentioned above.

Table (2-14) below shows comparison between three surveys (2005, 2007 and 2009) of the British firms in terms of different activities shown in Table (2-14) below. It can be seen that the innovation active and investment in 2009 is less than that in 2005 and 2007. This might be related to the economic factors. This means that the uncertain economy and surrounding external environment affects the business activities in 2009 more than that in 2005 and 2007.

Table (2-14): Percentage of enterprises who were innovation active in each survey wave, by type of activity

Type of activity	2005	2007	2009
Innovation active	66	73	62
Innovation investments	63	72	59
Product innovator	30	25	26
Process innovator	22	16	15
Abandoned or incomplete innovation activities	12	12	8

Source: BIS survey (2009, p.46).

2.4.2.5 Lack of national ICT strategy

Lack of national ICT strategy is also considered by researcher as a barrier to innovation. This point has been highlighted by Aubert (2004), and Al-Solbi (2006).

Pro-inno Europe (2010) discussed the ICT strategy in Italian organisations and indicated that the design of innovation and R&D policies is largely performed at government level, where the main priorities are identified. A recent positive sign on innovation governance is the increasing consultation with stakeholders, although their effective contribution in policy making is still limited. Regarding new policy measures, the most recent actions undertaken by the Italian Government are the following:

- Creation of public-private joint-labs in strategic sectors to sustain new high-tech industries

- Focus public intervention on 10 strategic programmes foreseen in the National Research Plan
- Establishment of 11 Technology Districts
- Promotion of Italian participation in Technology Platforms set up by the European Union
- Creation of strategic international research joint-labs
- Support the development of Information and Communication Technologies (ICT) and foster the adoption of ICT by enterprises (specially by SMEs)
- Incentive schemes that target sectors or activities identified as priority investment areas and that foster linkages between SMEs and research institutions (Innovation Technology Fund, Integrated Package Aid)

2.4.2.6 Lack of students studying engineering sciences

In their discussion to barriers and obstacles facing the SMEs in Germany Tiwari and Buse (2007) highlighted the fact that the shortage in skilled workforce is related to lack of students studying engineering and sciences. This is very important point and should be assessed on a national scale for any country.

The lack of students studying engineering sciences is highlighted by Professor Craig (2010) chair of engineering design, college of engineering, Marquette University. Professor Craig put out his vision for the engineering for the 21st century by the following statement:

"It is widely recognized that our nation's future and indeed our everyday lives are increasingly dependent on scientific and technical innovation. However, the United States is in an innovation crisis fuelled by a crisis in engineering education. The innovation shortfall of the past decade is real and there have been far too few commercial innovations that can transform lives and solve urgent human problems. Society's problems are getting harder, broader, and deeper and are multidisciplinary in nature. They require a multidisciplinary systems approach to solve them and present-day engineering education is not adequately preparing young engineers for the challenge. Basic engineering skills have become commodities worldwide. To be competitive, U.S. engineers must provide high value by being immediate, innovative, integrative, conceptual, and multidisciplinary. In addition, innovation is local – you don't import it and you don't export it! You create it! It is a way of thinking, communicating, and doing". He added that "to aid a company in fostering innovation and creating a culture of innovation within, to assist in enhancing their engineering workforce with the latest technology, tools, and design approaches, and to give engineering students the opportunity for industrial interaction throughout their four years, a College of Engineering needs to create an Industrial Innovation Consortium, where thought leaders and industry leaders can collaborate to solve specific customer problems, develop broad new solutions, and create best practices that help re-shape industry as we know it today".

The above statement reflects the importance of students studying engineering sciences in promoting the innovation.

2.4.2.7 Lack of intellectual property rights

This is also an important barrier since the inventor fears that when he/she discloses his/her invention to others the idea might be stolen by others. Therefore to protect the rights of the inventor a registration office should register the idea and support the inventor. The lack of intellectual property rights has been highlighted by Baldwin and Gellatly (2004) as a barrier to innovation.

2.4.2.8 Lack of cooperation with business partners

The cooperation between business partners is important point in accelerating the adoption and diffusion of the new technologies. This point has been highlighted by Tiwari and Buse (2007). The authors indicated that lack of cooperation with business partners/supply chain is a barrier to innovation.

Lee and Kim (2004) in their discussion to the barriers and drivers of SMEs in Korean companies highlighted two important points as barriers to the technology adoption. The first point is related to the business partner. This point is related to the data transaction between SMEs business partners. They indicated that SMEs, who are subcontractors or agents of the big enterprises that use (Electronic Data Interchange) EDI or e-commerce, tend to adopt EDI system or e-commerce solution. The second point is related to the buyer-supplier difficulty of communication by the internet. They found that there were difficulties in sending estimates and blueprints to their customers on the internet because their main customers were women in their 50s and were not familiar with the internet technology.

2.4.2.9 Brain drain

This is very important point face both developed and developing countries. The developing countries severely suffer from this problem. Many students come to developed countries to study and then when they finish they do not return to their home countries. This is a big loss to these countries. The brain drain problem has been highlighted by Aubert (2004), from the World Bank.

The above mentioned barriers are the most well documented barriers to innovation in SMEs in both developed and developing countries.

SciDev.Net (2011) highlighted the issue of the brain drain and its impact on the developing countries by referring to two articles published by centre for Global development and by the International Monetary Fund (1998). According to the SciDev (2011) the centre of global development (2008) broader issues face the developing the global development centre indicated the there are many issues face the developing countries including governance, brain drain, equity and access, and regulation and accreditation. While the international monetary fund article indicated that educated people immigrates from the developing countries to the United States and the OECD. The article concludes that their results suggest that in several developing countries the outflow of highly educated individuals is a phenomenon that policy makers cannot ignore.

The summary of both the external and internal barriers found in the literature are according to their countries summarised in Appendix (A).

2.5 Types of software/hardware usually used in organisations

The SMes usually use different types of software/hardware to carry out their daily activities. A wide variety of software such as word-processing, spreadsheet, AutoCAD, and other professional software usually used in SMEs in different areas of activities such as management, invoicing, tendering, etc. The hardware usually includes PC, workstation, Network, Internet, Intranet, Fax, landlines, mobiles, GPS etc. Examples of this software/hardware is shown in Table (2-15) below.

Table (2-15) Software Hardware used in SMEs

Software package Tools	Source	Title	Country
Word processing, spreadsheets, graphics representation such as PowerPoint, image manipulation such as "Photoshop", Design e.g. AutoCAD, MS project or primavera, simulation software such as SIMON1-Think, estimating, quantity surveying and cost planning, general e-mail-test only, sending receiving attachments documents e.g. drawing, pictures sound/video, video conferencing for meetings, web board (video with supported software via internet), internet, internet based network, knowledge management.	Peansupap (2004)	An Explanatory Approach to the Diffusion of ICT in Project Environment. PhD Thesis, School of Property, Construction and Project Management	Australia
MS Word, Word perfect, MS Excel, MS PowerPoint, Adobe PageMaker, MS outlook, CorelDraw, AutoCAD, ArchiCAD, WinQs, Catopro, Masterbill, QS Elite, Snape vector, In-house software, MS project, Internet Intranet, voicemail.	Oladapo (2007)	An investigation into the use of ICT in Nigerian construction industry.	Nigeria
Hardware			
Desktop, Laptop, notebooks	Oladapo (2007)	An investigation into the use of ICT in Nigerian construction industry.	Nigeria
Desktop, Laptop, telephone, fax,	Al-Solbi (2006)	Evaluating and Improving E-Readiness Assessment Methods and Tools. PhD thesis School of Computing Sciences, University of East Anglia, UK.	Saudi Arabia
Areas of IT software used			
1. Construction -management and administration Accounting and payroll, Cost engineering,, Company and project finance, Project	Paulson (1995, p.12)	The use of the ICT in construction industry was classified by the author in	Book

planning and scheduling, Materials management, Equipment management, Human resources management, Office management, Education and training		two areas construction management and construction engineering.	
2-Construction Engineering Estimating, Productivity improvement, Operations simulation, Quality assurance, Surveying, Computer –Aided Engineering Analysis, Computer-Aided Design and Drafting, Automated data acquisition and process control			

2.6 Summery to the barriers

In summary, the main external barriers to the adoption of the new technologies which were highlighted by the literature such as Al-Solbi (2006), Wicker (2001), Aubert (2004), Levratto (2009), Tiwari and Buse (2007), Baldwin and Gellatly (2004), Antonia et al (2009), and Katila and Shane (2005), Gordillo and Herrmann (2005). These barriers are related to the lack of government's regulations/legislations, financial support/and grants, lack of national strategies, standards, fluctuations of the Marco economy, lack of protection of intellectual property rights, and shortage of students studying engineering and science subjects. All these factors have impact on the adoption of the ICT systems in SMEs and they are beyond the control of the management of the SMEs firms. These barriers can be called as "external barriers"

A study from (US) related to the innovation in construction industry has been presented by Gambatese (2007). The study based on survey of 79 of Design-Build institute of America (DBIA), Associated General Contractors (AGC); On-line survey of 34 innovative product developers; and case studies of 10 diverse projects across the US. He indicated that there two sources of innovation. The first one is from within the firm (project manager, upper management, and superintendent) and the second one is from out side the firm (suppliers). The researcher found that the main barriers face the (US) construction industry are as follows:

Risk of failure; Low investment in R & D; Industry regulations/codes; Long payback period; Low return on investment; Competitive bidding; Fear of change; Not recognised by client; and Not applicable to all projects.

While the researcher highlighted the following motivators and benefits:

Cost; productivity; quality; schedule; competitive advantage; market share; safety; marketing; and new market.

On the other hand there are "internal barriers" which are within the control of the SMEs. Some of these barriers are related to the technology installed in the SMEs (hardware/software). Researchers such as Walker and Peasupap (2004), Rogers (1995), Al-Qirim (2006, 2007), Looi (2004), Garson (2006) and Muller-Seitz et al (2009). These barriers are mainly related to the difficulty of using the systems, complexity of the systems, security and compatibility of the systems.

Researchers such as Antonia et al (2009), Wicker (2001), Tiwari and Buse (2007), levratto (2009), Oak (2007), SusChem (2009), Auber (2004), McCoy et al (2005), Drury (2005), Zwick (2002), Frenkel (2003) and Hewitt-Dundas. (2006), were highlighted barriers related to the characteristics of the management, employees and the cost/finance of the innovation in the SMEs.

Arendt (2008) studied barriers face the SMEs from selected regions in Spain, Portugal and Poland and compared their findings with a survey on SMEs carried out in USA-California. They stated in their findings:
"the main barrier to better utilization of ICT and e-Business, and thus the main reason why SMEs face a digital divide, is not so much the lack of access to information technology ("material access" barrier) as the lack of proper knowledge, education and skilled owner-managers and employees within the enterprise ("skills access" barrier). As long as European SMEs do not realize this fact, so long will the scale of the digital divide in Europe continue to grow". This statement reflects the existing nature and types of obstacles in SMEs firms in Europe.

Further obstacles have been identified by Oladapo (2007), Yeomans (2005), Abbasi and Al-Mharmah (2003), Wilkinson et al (2002), which are: cultural, no global standards, commercial constraints, no legal framework, high investment cost, macro economics, lack of learning capabilities, end-users unpreparedness, old management's attitude toward new technology, lack of knowledge, a gap between research and development and practical operations, lack of strategic planning, lack of knowledgeable staff, no incentives, no link to vision realisation, lack of IT strategy, security, compatibility of software/hardware.

It can be concluded from the above that the ICT systems contribute positively toward the construction industry. However, there are there are some obstacles facing the utilisation of ICT in construction activities. The point that arises here is that not every organisation has an ICT infrastructure and therefore will lose out on the acknowledged benefits. This point was highlighted by researchers, such as Atiyyah (1989), Knight (1993) and Cuningham and Sarayrah (1994) in their discussion to transferring of ICT to the developing countries. The researchers indicated that despite of billions of dollars have been spent in products and information; the problem of transferring technology seems to be more severe in developing countries. They related this to the cultural differences between the developed

and developing countries. Moreover according to Rogers (2005) the adoption and diffusion of ICT in a society depends on socio-economic factors. Furthermore the literature suggests that there is no universal theory or model to explain technology diffusion in different cultures, Halawi and McCarthy (2006. Finally cultural factors are important in transferring and diffusing technologies in Arab countries, Hill et al (1998), Al Solbi (2006). Therefore it is important to examine the impact of the cultural factors on the adoption of technology and its diffusion in Libya.

Further barriers arise from policies and regulations imposed by local authorities, central and supranational governments (e.g. European Union directives}. These may include legal restraints relating to employment, consumer protection and environmental considerations, or a tax regime that might act as a disincentive for innovation. Also in countries where intellectual property is not adequately protected, innovators are much less likely to develop products which could be copied by competitors and produced much more cheaply. (Chesbrough 1999). Furthermore institutions such as governments whether local or supra-national because of their size are much more susceptible to inertia than smaller organizations and their resistance to change creates a further barrier.

The main conclusion from the above-mentioned studies can be summarised below:

1) Both developed and developing countries indicate that there are barriers to innovation and creativity in construction industry.

2) In general it can be said that the main barriers to innovation in an organisation could be categorised into two main components '**internal' and 'external barriers'**. The internal barriers are related to those barriers within the organisation, e.g. leadership/educational level of the managers, gender, style of management, people and skills, management structure, motivation, incentive schemes, culture, etc. While the external barriers are related to the government regulations and framework, competition, tax, inter-organisational barriers, market, economy etc.

3) Innovation and creativity is a very important factor for any organisation to progress and thrives. Investment in innovation could increase the productivity, reduce costs and improve the quality of any product, processes and services.

2.7 Conclusions

1 The innovation and IT adoption of the new technologies is vital for any business to survive and to competitive in these days.

2. In spite that there are so many papers and reports have been published in the field of innovation and IT adoption of the new technology there is no common (authoritative) definition to the term 'innovation'. However, the innovation could be considered any new idea, new technology, new product, process, service, procedure and methodology.

3. In spite that many theories and models have been presented to explain the innovation and IT adoption of the new technologies no theory can claim its validity and uniqueness to explain the innovation and diffusion of ICT systems in organisations, The researcher has reviewed most of the available published literature (theories and models) in the field of innovation and IT adoption for different countries, both developed and developling countries and found that no definite theory or perspective can claim its validity to explain the the IT adoption and diffusion in organisations. This is related to the fact that many factors affect the adoption of the technology. These factors are related to the characteristics of the technology itself (complexity, cost, security of the information and so on); to the characteristics of the user (lack of knowledge, lack of perceived usefulness, resistance to change, age, experience, culture etc) and to the effect of the external environment (such as government financial support, lack of regulations, unstable economy etc).

4. Most published theories and models were developed in developed countries and this mostly fit the working environment of that country in which they have been developed. This related to the fact that each society has its uniqe features and understanding to the importance of the IT in its daily lives. This will affect the technology adoption and utilisation.

5. Most skilled manpower educated in the western countries and specilised in the field of IT do not go back to their native counries due to political and economical factors. This is an important issue which has led to the 'brain drain' of skilled people from developing countries.

6. The development in the field of technology is very rapid and its needs countinoues research and learning of its new features.

7. The education system for any country is the core of crerating the skilled manpower to run the IT systems of that country. Therfore a special attention should be given to this important sector to create a base knowledge which can take the resposibilities to facilitate adoption and diffusing the technology within the society and also within the organisations.

8. Very limited literature has been published in the field of IT adoption in the Libyan construction organisation. Therefore, this study has been designed to explore the features of this important sector. Two methologies qualitative and quantitative were devised to investigate the features of this sector. An IT adoption model based on the literature has been derived to expore the characteristics of the Libyan construction organisations. This will be discussed in detail in the next chapter i.e. chapter 3.

Chapter Three: Conceptual Model Development

3.1 Introduction

This chapter deals with the development of the conceptual model for this research. It has included the following headings: the constructs of the IT model, the dependent variable: IT adoption; the independent variables such as, the relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions, and subjective norms. This chapter also has included moderator variables such as voluntariness, external orientation, achievement orientation, company slack, pro-activity, environment dynamism, business attitude toward IT adoption, manager age, degree, speaking foreign language, number of employees, type of business, time in business, type of company, having an IT department, and having an IT budget. It also included conclusions at the end of this chapter.

3.2 The constructs of the IT adoption Model

In the previous section major theories and models related to the adoption and diffusion of technology were presented. The benefits and the obstacles to the technology adoption and diffusion were also discussed. The latest theory of acceptance of technology UTAUT presented by Venkatesh (2003) has been briefly examined. This theory has been based on eight previous derived theories and models in information technologies. The theory is mainly related to the technology acceptance by managers and it did not discuss the diffusion of the technology. In their review to the available literature on the adoption of information technology, Lanzolla and Suarez (2007) say:

> *'A closer examination of companies suggests that technology use does not necessarily follow on from technology adoption. In many industries, technologies are sometimes adopted and then used very little or not at all'.* They also added *'automatic use after adoption might even be the exception rather than the rule, at least in some industries and for some technologies. This scant attention to the differences between technology adoption and technology use means that existing technology diffusion literature has also failed to identify and distinguish the type of organisational actors that are involved in the often separate decisions to adopt and to use a new technology'.*

As far as Libya is concerned the construction industry is under-researched and the utilisation of the ICT systems is not well established in the country. This point has been highlighted by Grifa (2006). As already mentioned, Grifa (2006) studied the construction practices in Tripoli (Libya) and diagnosed a skilled workforce was lacking and

highlighted that present practice consists of using traditional communication methods (based on verbal and written means). He indicated that there is an overall weakness in the ICT systems and this need to be studied.

Since the literature has shown that there is no single theory which can claim its validity in explaining the adoption and diffusion of the ICT, Halawi and McCarthy (2006). , therefore, a proposed model has been suggested for this research to explain the adoption and diffusion of the ICT in Libyan. The constructs which included in the proposed model has been based on the literature. These constructs are shown in Table (3-1) below. The proposed model includes 27 constructs (1 dependent variable, 9 independent variables and 16 moderating variables) based on the reviewed literature. These constructs are as follows.

Table (3-1): Proposed model for this research

No	Constructs	Source of information
	Independent variables	
1	Relative advantage	Moore and Benbasat (1991), Lee (2004), Nan et al (2008), Tan et al (2011), Duan et al (2010), Park (2009), Robertson (1990), Hussein (2009), Jebeile (2003), Dong (2011)
2	Compatibility	Moore and Benbasat (1991), Nan et al (2008), Lee (2004), Duan et al (2010), Al-Gahtani (2003), Tan et al (2011), Sultan and Chan (2000), Grandson and Pearson (2004), Jebeile (2003)
3	Image	Moore and Benbasat (1991), Nan et al (2008), Alessia et al (2009), Chen et al (2011), Kim and Lee (2010), Jebeile (2003)
4	Ease of use	Moore and Benbasat (1991), Nan et al (2008), Lee (2004), Park(2009), Parveen and Suliman (2008), Jebeile (2003), Duan et al (2010), Tan et al (2011)
5	Result demonstrability	Moore and Benbasat (1991), Nan et al (2008), Nov and Ye (2008), Mahod et al (2005), Dong. Q (2011)
6	Visibility	Moore and Benbasat (1991), Jebeile (2003), Rosner (1968), ITU (2001), Nan et al (2008)
7	Trialability	Moore and Benbasat (1991), Nan et al (2008), Duan et al (2010), Tan et al (2011), Al-Gahtani (2003), Mahmod (2005), Lee (2004), Rogers (1995), Chong and Pervan (2007), Jebeile (2003)
8	Facilitating Conditions	Kijsanayotin et al (2009), Rosen (2005), Dong (2011)
9	Subjective Norm	Kijsanayotin et al (2009), Park (2009), Chismar and Wiley-Patton (2002), Fishbein and Ajzen,(1975), Venkatesh et al (2003), Sun and Zhang (2006)
	Moderating variables	
10	Voluntariness	Moore and Benbasat (1991), Chismar and Wiley-Patton (002), Ventatesh and Davis (003), Rogers (1995), Sun and Zhang (2006), Kautz and Pries-Heje (1996), Nan et al (008), Kijsananyotin et al (2002)
11	External orientation	Nystrom et al (2002), Narver and Slater (1990), O'Regan and Ghobadian, (2005)
12	Achievement orientation	Nystrom et al (2002), Haygroup (2006), Abu-Hassim et al (2011), Kassim and Sulaiman (2011)
13	Company slack	Nystrom et al (2002), Gong and Yanjuan (010), Damanpour (1987),

		Miller and Friesen (1998), Adkins (2005), Ruiz-Moreno et al (2008), Lee (2004)
14	Pro-activity	Perez-Luno et al (2010), Perez-Luno et al (2010), Miles and Snow (1987)
15	Environmental dynamism	Perez-Luno et al (2010), Perez-Luno et al(2010), Khandwalla (1977), Miller and Friesen (1978), Zhou (2006), Priem et al (1995) and Chirani et al (2011)
16	Business-Level Attitude Toward IT Adoption	Frambach and Schillewaert (2002), Lakhanpal (1994), Thong and Yap (1995), Rosen (2005), Hussein (2009), Tan et al (2007)
17	Number of employees	Damanpour (1992), Lee and Xia (2006), Yao et al (2002), Nystrom et al (2002), Malhotra and Sing (2007), Salavou and Lioukas (2004), Scupola
18	Type of Business	Tan et al (2011), Trornatzky and Klein (1982)
19	Time in Business (org.age)	Ismail et al (2009), Flanagin (2000), Kimberly and Evanisko (1981), Murphy and Tan (2003)
20	Type of organisation	Lee and Xia (2006), Al-Solbi (2006), West and Lu (2009)
21	IT department	Al-Solbi (2006)
22	Manager age	Hunter and Kemp (2004), Al-Mharma (2003), Daly and Kitchell (1995), Taylor (1975), Hambrick and Mason (1984), Burke and Light (1981), Hung and Lo(2010), Sun and Zhang (2006)
23	Degree	Lera-Lopez (2007), Hung and Lo (2010)
24	Speaking foreign language	Paul (2006), Global Reach (2004), Al-Solbi (2006)
25	IT budget	Al-Solbi (2006), Tan et al (2011), Goode and Stevens (2000)
	Dependent variable	
26	Type of IT applications used in your company	Swamidass (2003); http://www.apdip.net/publications/iespprimers/eprimer-sme.pdf, and researcher experience

It is clear from Table (3-1) that the independent variables include: relative advantage, compatibility, image, ease of use, visibility, trialability, facilitating conditions and subjective norms. The moderating variables include three factors considered in this model. The first factor is IT adoption factor which includes voluntariness, external orientation, company slack, pro-activity, environmental dynamism and business-level attitude toward IT adoption. The second factor is related to the organisation characteristics such as: number of employees, type of business, time in business (organisation age), type of organisation (public/private and foreign), having IT department and having IT budget .The third factor is related to manager characteristics such as: manager age, degree and speaking foreign language. The dependent variable is the IT adoption. All the variables considered in this model are shown in Figure (3-1) below.

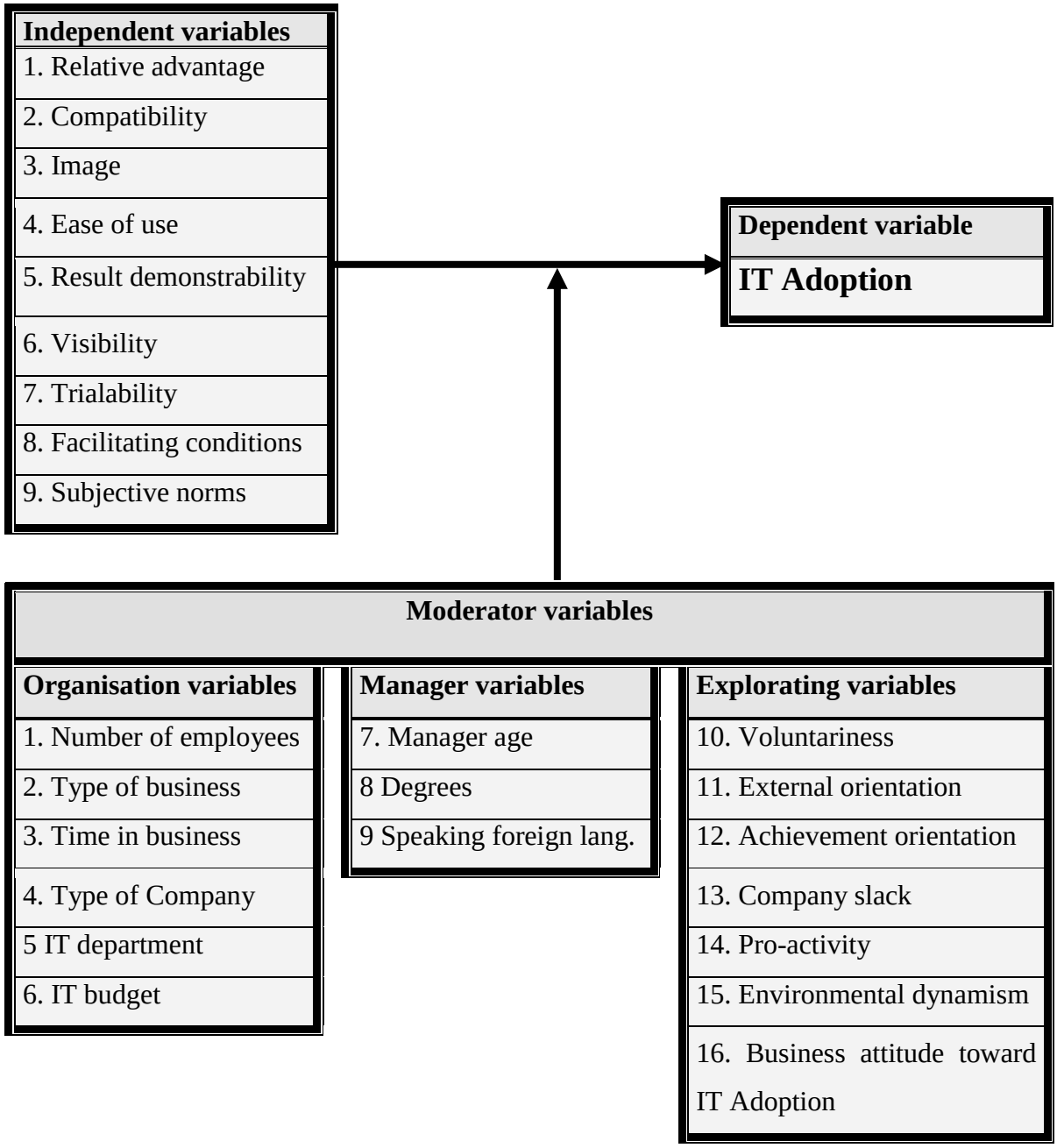


Figure (3-1): Conceptual model for this research

The constructs of the model shown in figure (3-1) are explained below.

3.3 The dependent variable

The dependent variable is the IT adoption of the technology in the surveyed organisations. Two questions were used to derive the dependent variable. The first question is: Do you use the following software? The second question is to rate the skills at which the software is used. This will be discussed in detail in chapter 6, result analysis.

3.4 The independent variables

Nine independent variables were used in this model as shown in Figure (3-1) above. These variables are: relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms. These variables are explained below.

3.4.1 Relative advantage

Relative advantage has been defined by Golding et al (2008) as 'the degree to which an innovation is perceived as being superior to its predecessor in terms of economic profitability, low initial cost, a decrease in discomfort, savings in time and effort, and the immediacy of the reward'. The relative advantage has been discussed above in the literature by many researchers such as Rogers (1995), Garson (2006), El-Gohary et al (2007). Understanding of the relative advantage of using the technology to the business activities is an important factor which could persuade managers and decision makers to adopt the new technology. Parveen and Suliman (2008) conducted a study on the mobile industry in Malaysia. They found that perceived usefulness of the technology has a positive impact on the intension to use the technology. They also found the perceived ease of use affect the perceived usefulness. The perceived benefits from the utilisation of internet which encourage the SMEs to adopt the new technologies also highlighted by Cronin (1995) (cited in Abell and Lim (1996). The perceived benefits of using the internet categorised into three main areas as show in Table (3-2) below.

Table (3-2): Perceived benefits from using the internet in SMEs

Area of Use	Sample Uses	Potential Benefits
customer relations	sales marketing, advertising market research customer support	increased market share reach a wider market greater customer satisfaction
dealing with suppliers	product information product support on-line ordering	lower operational costs greater flexibility of supply
internal company operations	Communications information gathering Resource sharing job recruitment	access to expertise regardless of location more awareness of business environment increased productivity

Source: Cronin (1995- cited in Abell and Lim, 1996).

In general the relative advantage is an important factor in the innovation and adoption of the new technologies. Table (3-3) below shows selected source of information to support this innovation attributes factor.

Table (3-3): Relationship between relative advantage/innovation -literature

	Independent variables	Country	Technology	Sample	Findings	Source
1	**Relative advantage**	Taiwan	IT adoption	Individuals	+	Lee (2004)
		China	e-mail	org.	+	Nan et al (2008)
		Malaysia	ICT adoption	org	+	Tan et al (2011)
		UK	e-learning	Individuals	+	Duan et al (2010)
		Korea	IT adoption	Individuals	+	Park (2009)
		USA	Innovation product	org.	+	Robertson (1990)
		Egypt	Web adoption	org	+	Hussein (2009)
		Australia	Innovation	Individuals	+	Jebeile (2003)
		China	Innovation		+	Dong (2011)

The questions used in relative advantage of this study adapted from Moore and Benbasat (1991). Six questions were used in this factor to measure the relative advantage on scale of (1-6) as shown in Table (3-4) below.

Table (3-4): Relative advantage questions

Questions		Strongly agree	Agree	Slightly agree	Slightly disagree	disagree	Strongly disagree
	Relative advantage	**6**	**5**	**4**	**3**	**2**	**1**
A-1	Using IT improves the quality of the work we do						
A-2	Using IT improves our job performance						
A-3	Using IT increases our effectiveness						
A-4	Using IT gives us greater control over our work						
A-5	Using IT increases our productivity						
A-6	Overall, we find using IT advantageous in our job						

3.4.2 Compatibility

The compatibility has been defined by Moore and Benbasat (1991) as "the degree to which use of the personal work station (i.e. computers, terminal, software etc) is compatible with, or requires change, in one's job". While Rogers (1983, 223) defined the compatibility 'as the degree to which using an innovation is perceived as consistent with the existing socio cultural values and beliefs, past and present experiences, and needs of potential adopters'.

The importance of compatibility in innovation and adoption has been acknowledged by many researchers such as Rogers (1995), Garson (2006), Walker and Peasupap (2004), Katz and Shapiro (1986), Gohary et al (2007), Venkatesh et al (2003, (McAdam et al, 2002, 2008). Al-Gahtani (2003) studied the computer adoption by the employees of 56 Saudi organisations and found that compatibility has a positive relationship with the adoption and use of computer in the surveyed organisations. The compatibility could also mean the compatibility between the software/hardware, Voronoff (2011), Rocco (2010), Al-Qirmi (2006, 2007) and Garson (2006). Sometimes it is difficult to transfer data/information from one application to another, Al-Qirmi (2006, 2007) Garson (2006). This means that it is difficult to import/export data between packages installed on the same or different computers. This is also depends on the operating system and its recognition of the input/output from different packages. Selected source of information to show the relationship between compatibility/innovation is shown in Table (3-4) below.

Table (3-5): Relationship between compatibility/innovation -literature

2	**Compatibility**	China	e-mail	Org	+	Nan et al (2008)
		Taiwan	IT adoption	individual	+	Lee (2004)
		UK	e-learning	individuals	+	Duan et al (2010)
		Saudi Arabia	Computer adoption	org	+	Al-Gahtani (2003)
		Malaysia	ICT adoption	org	+	Tan et al (2011)
		USA	IT	Org	Not sig.	Sultan and Chan (2000)
		USA	e-commerce	Org	+	Grandson and Pearson (2004)
		Australia	Innovation	individuals	+	Jebeile (2003)

The questions used in this research adapted from Moore and Benbasat (1991) as shown in Table (3-6) below:

Table (3-6): Compatibility questions

	Question	Strongly agree	Agree	Slightly agree	Slightly disagree	disagree	Strongly disagree
	Compatibility	**6**	**5**	**4**	**3**	**2**	**1**
B-1	Using IT is compatible with all aspects of our wok						
B-2	Using IT is compatible with our current situation						
B-3	We think that using IT fits well with the way we like to work						
B-4	Using IT fits into our works style						

3.4.3 Image

The image has been defined by Moore and Benbasat (1991) as 'the degree to which the use of the personal work station (i.e. computers, terminal, and software) enhance one's image or status within the organisation'. Schultz (2007) in his discussion to the organisation image indicated that 'organization image is the perceptions that different people hold of an organization. Such perceptions can have different sources depending on how well people know the organization. Some perceptions derive from individual experiences and impressions of the organization, while others are influenced by the marketing and communication activities seeking to influence the image of the organization. Image is important for an organizations ability to attract and retain relationships with its different internal and external constituencies.' Chismar and Wiley-Patton (2002) studied the adoption of the IT in Hawaiian health organisations found that the image and subjective norms are not significant in IT adoptions by the paediatricians working in Hawaiian health sector. A study has been carried out by Jebeile (2003) on the Australian secondary college teachers found that the image attribute did not emerge as significant in either of the contexts examined.

An interesting study has been carried out by Kim and Lee (2010) to find the relationship between the corporate image and customer loyalty in mobile communications service markets in South Korea. The researchers found that there is a positive relationship

between customer loyalty and corporate image. Table (3-7) below shows selected research on image factor.

Table (3-7): Relationship between image/innovation - literature

3	**Image**	China	e-mail	org	+	Nan et al (2008
		USA	Business-Innovation	Documents	+	Alessia et al (2009)
		China	Business-Innovation		+	Chen et al (2011)
		Korea	Mobile communication	individual	+	Kim and Lee (2010)
		Australia	Innovation	individuals	-	Jebeile (2003)

The questions used in this image construct have been adapted from Moore and Benbasat (1991) as shown in Table (3-8) below.

Table (3-8): Image questions

	Question	**Strongly agree**	**Agree**	**Slightly agree**	**Slightly disagree**	**disagree**	**Strongly disagree**
	Image	**6**	**5**	**4**	**3**	**2**	**1**
C-1	Using IT improves our image within the company						
C-2	People in our company who use IT have more prestige than those who do not						
C-3	People in our company who use IT have a high profile						
C-4	Having IT is status symbol in our company						

3.4.4 Ease of use

Lorenzi (2011) pointed pout that a significant number of major corporations and academic institutions now study human-computer interaction (HCI). He added that historically and with some exceptions, computer system developers have not paid much attention to computer ease-of-use, and many computers users today would argue that computer makers are still not paying enough attention to making products 'user-friendly'. The impact of the ease- of- use on the adoption and diffusion of the technology has been acknowledged by many researchers such as Rogers (1995), Venkatesh et al (2003, (McAdam et al, 2002, 2008), Davis (1989, 1993), Peansupap (2004) and Walker and Peansupap (2004), Benbasat (2001, Gohary et al (2007), Morris and Dillon, 1997) and Ugwu et al (2007).

Tan et al (2011) found that the complexity of the ICT has a negative relationship with the ICT adoption in Malaysian SMEs. They related this to lack of the technical skills and knowledge in the ICT field. They highlighted this point to the bosses of the company and they indicated that in order for these companies to overcome these problems, they should hire the right technical personnel and provide training for all the staff members in these companies. Table (3-9) below shows selected research related to ease of use.

Table (3-9): Relationship between ease of use/innovation - literature

4	**Ease of use**	Chain	e-mail	org	+	Nan et al (2008)
		Taiwan	IT adoption	individuals	+	Lee (2004)
		Korea	IT adoption	individuals	+	Park(2009)
		Malaysia	Wireless Technology	individuals	+	Parveen and Suliman (2008)
		Australia	Innovation	individuals	+	Jebeile (2003)
	Complexity	UK	e-learning	individuals	-	Duan et al (2010)
		Malaysia	ICT adoption	Org	-	Tan et al (2011)

The questions used in this research were adapted from Moore and Benbasat (1991) as shown in Table (3-10) blow.

Table (3-10): Ease of Use questions

	Question	**Strongly agree**	**Agree**	**Slightly agree**	**Slightly disagree**	**disagree**	**Strongly disagree**
	Ease of Use	**6**	**5**	**4**	**3**	**2**	**1**
D-1	We believe that IT is cumbersome to use						
D-2	Using IT requires a lot of effort						
D-3	Using IT is often frustrating						
D-4	We believe that it is easier to get IT to do what we want to do						
D-5	Learning to operate IT is easy for us						
D-6	Overall, we believe that IT is easy to use						

3.4.5 Results demonstrability

Chismar and Wiley-Patton (2002) defined result demonstrability 'is the tangibility of the results of using the technology. Perceived ease of use both directly and indirectly impacts on perceived usefulness'. Jebeile (2003) in their study to the teacher adoption of Web technology in a secondary college in Sydney, Australia, found that the that the innovation adoption variables of relative advantage, compatibility, visibility, ease of use, results demonstrability, and trialability should be considered by school administrators seeking to increase the rate of adoption of e-Learning within their organisation.

Mahmod et al (2005) studied the intention of e-learning by the Malay and Chinese 169 e-MBA students. They found that result demonstrability influences the intention of potential user towards technology adoption for e-MBA. Positive relationship was found between result demonstrability and both attitude and behaviour intention. Table (3-11) shows result demonstrability for selected research.

Table (3-11): Relationship between result demonstrability/innovation - literature

5	**Result demonstrability**	China	E-mail	Org.	+	Nan et al (2008)
		USA	Resistance to change	Individuals	-	Nov and Ye (2008)
		Malaysia	e-learning	Individuals	+	Mahod et al (2005)
		Australia	Innovation	Individuals	+	Jebeile (2003)
		China	Innovation	Individuals	+	Dong. Q (2011) (

The questions used in this research construct adapted from Moore and Benbasat (1991) as shown in Table (3-12) below.

Table (3-12): Result Demonstrability questions

	Question	Strongly agree	Agree	Slightly agree	Slightly disagree	disagree	Strongly disagree
	Result Demonstrability	**6**	**5**	**4**	**3**	**2**	**1**
E-1	We would have no difficulty telling others about the results of using IT						
E-2	We believe we could communicate to others the consequences of using IT						
E-3	The results of using an IT are apparent to us						
E-4	We would have difficulty explaining why using IT may not be beneficial						

3.4.6 Visibility

Moore and Benbasat (1991) defined the visibility as 'the degree to which the use of the personal workstation (PWS) enhances the one's image or status within the organisation', and they defined the PWS in their instrument accompanying questionnaire 'as a set of computerised tools designed for and individual. While Chirani et al. (2011, p.8595) defined visibility as 'the extent to which the benefits or attributes of the innovation are visible to prospective adopter'. Jebeile (2003) found that the visibility is an important factor affects the secondary school college in Australia in their adoption of the web technology. It usually consists of a personal or microcomputer with one or more software packages, such as word-processing program or speared sheet, or a computer terminal hooked up to a central mainframe computer, gain with appropriate software'. He found that visibility is an important factor in the adoption of the technology.

Jebeile (2003, p.15) Visibility examines how apparent or visible the use of the innovation is in the organisation or school context'. Jebeile (2003) carried out multiple regression between the ICT adoption and with seven innovation factors (relative advantage, compatibility, image, visibility, ease of use, results demonstrability, and trialability) to predict the dependent variable, teachers' future use of the Web for purposes of teaching delivery. The researcher found a positive relation between visibility and the ICT adoption in the derived model.

Table (3-13) below shows the relationship between visibility and adoption in selected literature.

Table (3-13): Relationship between visibility/innovation - literature

6	**Visibility**	Chain	E-mail	Org.	+	Nan et al (2008)
		Australia	Innovation	individuals	+	Jebeile (2003)
		USA	Innovation	Org	+	Rosner (1968)

The questions of the visibility constructs were adopted from those used in the Moore and Benbasat (1991) model as shown in Table (3-14) below.

Table (3-14): Visibility questions

	Question	**Strongly agree**	**Agree**	**Slightly agree**	**Slightly disagree**	**disagree**	**Strongly disagree**
	Visibility	**6**	**5**	**4**	**3**	**2**	**1**
F-1	We have seen what others do using their IT						
F-2	In our company, one sees IT in many places						
F-3	IT is not very visible in our company						
F-4	It is easy for us to observe others using IT in our company						

3.4.7 Trialability

Trialability defined by Fichman and Kemere (1993) as 'technology that can not be easily installed in stages and still obtain benefits effectively require that organisations compress all learning about the technology into a pre-implementation phase. Also, large scale implementations require inherently greater implementation expertise than small ones'. While Moore and Benbasat (1991) as 'the degree to which it is possible to try using the personal work station PWS'. The trialability was introduced in the Rogers (1995) theory of diffusion of innovation and also used by many researchers in their adoption to the technology models such as Moore and Benbasat (1991) and Duan et al (2010).

A summary of selected research papers related to the effect of the trialability on the innovation and adoption of the new technologies are shown in Table (3-15) below. Almost all researchers found positive relationship between IT adoption and trialability. Trialability gives the use a chance to try the technology before deciding to adopt it.

Table (3-15): Relationship between trialability/innovation - literature

7	**Trialability**	China	e-mail	Org	-	Nan et al (2008)
		UK	e-learning	individuals	+	Duan et al (2010)
		Malaysia	ICT adoption	org	+	Tan et al (2011)
		Saudi Arabia	Computer adoption	org	+	Al-Gahtani (2003)
		Malaysia	e-learning	individuals	+	Mahmod (2005)
		Twain	IT adoption	individuals	+	Lee (2004)
		Australia	IT adoption	general	+	Rogers (1995)
		Australia	e-commerce	Org	-	Chong and Pervan (2007)
		Australia	Innovation	individuals	+	Jebeile (2003)

The trialability construct of this study model adapted from Moore and Benbasat (1991) as shown in Table (3-16) below.

Table (3-16): Trialability questions

	Question	**Strongly agree**	**Agree**	**Slightly agree**	**Slightly disagree**	**disagree**	**Strongly disagree**
	Trialability	**6**	**5**	**4**	**3**	**2**	**1**
G-1	We usually have good opportunity to try various IT applications						
G-2	We know where we can go to satisfactorily try out various uses of IT						
G-3	Before deciding whether to use any IT applications, we are able to properly try them out						
G-4	We are permitted to use IT on a trial basis long enough to see what it could do						

3.4.8 Facilitating conditions

The facilitating conditions might be defined as the degree at which an individual feels that the required resources to the use the IT systems are available in his her/organisations. The facilities conditions were used a construct in IT innovation and diffusion models e.g. Rogers (1995), Venkatesh et al (2003) and Kijsanayotin et al (2009). Datta (2011) discussed factors affecting the adoption dynamics of technologies among 172 users in 37 developing countries and found that the facilitating conditions play a critical moderating role in understanding actual e-commerce adoption.

The relationship between the IT adoption and facilitating conditions was found to be positive in this study and this finding also supported by the literature, Dong (2011), Datta (2011) and Kijsanayotin et al (2009). This means that the more the required resources for adoption an innovation, the more the adopters and user of that innovation. The relationship between facilitating conditions and innovation is shown in Table (3-17) below.

Table (3-17): Relationship between facilitating conditions/innovation – literature

8	**Facilitating conditions**	USA	Innovation	Individuals	Not sig	Rosen (2005)
		China	Innovation		+	Dong (2011)
		Thailand	Adoption	org	+	Kijsanayotin et al (2009)

The questions of the facilitating conditions used in this research are shown in Table (3-18) below.

Table (3-18): Facilitating Conditions questions

N: Facilitating Conditions							
	Question	**Strongly agree**	**Agree**	**Slightly agree**	**Slightly disagree**	**disagree**	**Strongly disagree**
	Facilitating Conditions	**6**	**5**	**4**	**3**	**2**	**1**
N-1	We have the resource necessary to use IT						
N-2	We have knowledge necessary to use IT						
N-3	The company staffs in the main office are available for assistance with IT difficulties.						
N-4	We have knowledge sources (e.g. books, documents, consultants) help us learn about IT system.						

3.4.9 Subjective norms

Subjective norm is defined as a person's perception that people who are important to him think he should or should not use the technology Chismar and Wiley-Patton (2002). While Fishbein and Ajzen,(1975) indicated that subjective norms refer to perceptions that most people who really matter to the individual, think that they either should or should not perform the behaviour in question.

Kautz and Pries-Heje (1996) in their book have indicated that subjective norm is an important factor in theories of diffusion and adoption of the new technology. The authors indicated that subjective norm has a significant effect on both usage and attitude. This point is also highlighted by other researchers such as Venkatesh et al (2003) and Sun and Zhang (2006).

Selected papers show a positive relationship between the subjective norm and innovation are shown in Table (3-19) below.

Table (3-19): Relationship between subjective norm/innovation - literature

9	**Subjective norms**	Korea	e-learning	individuals	+	Park (2009)
		Thailand	Adoption	org	+	Kijsanayotin et al (2009)

The construct related to the subjective norms has been adapted from Kijsanayotin et al (2009) as shown in Table (3-20) below.

Table (3-20): Subjective Norms questions

	Question	**Strongly agree**	**Agree**	**Slightly agree**	**Slightly disagree**	**disagree**	**Strongly disagree**
	Subjective Norms	**6**	**5**	**4**	**3**	**2**	**1**
P-1	The majority of leading companies within the supply chain use IT						
P-2	The majority of trading parties within the supply chain use IT						
P-3	The majority of peer competitors use IT						
P-4	The government actively promotes IT						
P-5	IT adoption is supported by government grants						
P-6	Our employees encourage us to use the IT						

3.5 Moderator variables

In spite that there are many models have been derived in the filed of IT innovation to explain the adoption and use of the technology, these models are inconsistent in their findings, Sun and Zhang (2006). Sun and Zhang (2006) highlighted the point that little attention has been give to the moderating variables. In their review to the literature, the

researchers suggested ten moderating variables. They categorised these variables into three categories. The first category is organisational factors which includes *(voluntariness of IT use, nature of task and profession*). The second category is technology factors which includes (*technology complexity, purpose of using IT (work-oriented vs. entertainment oriented), individual vs. group technologies*. The third category is individual factors which include (*gender, intellectual capacity, experience, age, cultural background*). In spite that the researchers listed 10 factors considered as moderator variables, however, they haven't cover all the moderator variables, for example the industry type has not been considered as moderating factor as it was considered by Tan et al (2011).

The moderator variables considered in this research include IT adoption factors (voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, and business-level attitude toward IT adoption). Plus number of employees, type of business, time in business, type of company, IT department, age of manager, degree, speaking foreign language and IT budget. These are explained below.

3.5.1 Voluntariness

Chismar and Wiley-Patton (2002) defined voluntariness 'is the extent to which one perceives the adoption decision as non-mandatory'. While Moore and Benbasat (1991) defined the voluntariness as 'the degree to which the use of personal work station is perceived as being voluntary. While Ventatesh and Davis (2000) defined the voluntariness as 'the extent to which potential adopters perceive the adoption decision to be non-mandatory'. The construct voluntariness was used by Rogers (1995) in developing his theory of diffusion of innovation in Australia as explained earlier in the literature.

Kijsanayotin et al (2009) studied the IT acceptance in Thailand heath centres. The researchers found that the IT acceptance is influenced by performance expectancy, effort expectancy, social influence and voluntariness.

Sun and Zhang (2006) discussed the voluntariness and its effect in the innovation and diffusion models. Users in the mandatory setting have to comply with the managerial or organisational demands or rules which are not required in the voluntary setting Sun and Zhang (2006). The compliance means a direct influence of subjective norm (SN) on behaviour intention (BI) and usually exists in mandatory context, Sun and Zhang (2006). This means that in mandatory context that the subjective norm (SN) has direct effect on

the behaviour intention but not in the voluntary context, Sun and Zhang (2006). Therefore, the voluntariness was considered as a moderating variable between the subjective norm (SN) and behaviour intention (BI) and the moderating effect wear off with time, Sun and Zhang (2006). Kautz and Pries-Heje (1996) in their discussion to the diffusion and adoption of the new technology indicated that voluntariness is inversely related to both usage and attitude.

Nan et al (2009) studied the e-mail uses by Chinese SMEs senior managers and found that there is positive relationship between e-mail use and the voluntariness innovation factor. The voluntariness construct is selected in this study and its questions were modified from Moore and Benbasat (1991) model.

3.5.2 External Orientation

In their explanation to the external orientation Nystrom et al (2002) pointed out that employees within organisations that have better customer orientation enact and perform more effective boundary-spanning roles. It can be said that organisations lack the external orientation means lack of contact with their customers. In order for organisation to compete with their rivals, they should be adopted the technology to serve their customers and to keep them ahead of their rivals. Nystrom et al (2002) pointed out that a technology not used at a minimal level of capacity can create a financial loss resulting in fewer adoptions in the future.

Narver and Slater (1990) defined the customer orientation as sufficient understanding of one's target buyers to be able to create superior value for them continuously. The questions used in this study construct were adapted from Nystrom et al (2002).

An interesting study has been carried out by O'Regan and Ghobadian, (2005) on the impact of strategic orientation and environment perceptions in 1000 SMEs in both engineering and electronic companies in the UK. The researchers found that the SMEs which were studied in the sample can be classified as either propestors or defenders. The prospectors are more likely to engage in new product development, whereas the defenders are five times more likely to modify an existing product than introduce a newly patent product. They also found that the prospective-type firms tend to deploy more new process technologies and leading management practices compared with defender type firms,

particularly in a turbulent operating environment. They found also that the defenders recognise the need to 'catch up' and to introduce process technologies and to innovate in turbulent operating environment. The researchers recommended that chief executives are encouraged to align their strategic orientation with their innovation strategy. In addition, defender type firms should consider the greater use of process technologies and management practices

3.5.3 Achievement Orientation

BusinessDictionary.com defined the achievement orientation as 'management which sets challenging goals, assists in training, emphasises improvement, and expects the highest levels of performance'.

Haygroup (2006, p.6) Canadian public service report, defined the achievement orientation as *'works to achieve results and improve individual and organizational contribution. Achievement Orientation is a concern for working well or for surpassing a standard of excellence. The standard may be one's own past performance (striving for improvement); an objective measure (results orientation); outperforming others (competitiveness); challenging goals one has set; or trying something new that will improve organizational results (innovation). Achievement Orientation also involves effectively managing internal and external resources to achieve the Government's goals.'*

While Nystrom et al (2002) in their study to the impact of the achievement orientation on innovations, they pointed out that relative advantage of an innovation can be framed in terms of profitability, status, or savings. They added that achievement oriented firms will be less bureaucratic and rules oriented, and more likely to be goal oriented by trying to attain a certain level of excellence, and managers may become more willing to adopt innovations capable of offering substantial benefits even if the innovations involve a departure from the traditional practices. The construct of achievement orientation used in this study model adapted from Nystrom et al (2002).

Abu-Hassim et al (2011) carried out a research on 398 firms in Malaysia. They found that the entrepreneurial orientation and innovativeness exert a positive effect on firm business performance; market orientation exhibits a negative effect on firm performance. They also

found that the external environmental factors do have a moderating effect on the relationship between market orientation and firm performance.

Kassim and Sulaiman (2011) found that supportive oriented leadership style of top managers had a significant relationship with market orientation in Malaysian 78 SMEs. For managers, it gives better understanding and insight into how their behaviors and leadership styles will influence the development of market orientation in their organizations.

It can be concluded that the achievement orientation is important factor which promote the success of any organisation. The supportive managers play an important part in achieving the goals of the organisation.

3.5.4 Company slack

Gong and Yanjuan (2010) in their reviewing to the organisational stack stated that**:**

"*There are various definitions of slack in the existing literature on slack, all of them reflect the notion of excess resources that both cushion the organization from environmental changes and represent an opportunity for discretionary allocations, such as to innovation activities. Organizational slack refers to those resources, which an organization has acquired which are not committed to a necessary expenditure. In essence these are resources which can be used in a discretionary manner. It signifies various ways in which resources and energy that may have been devoted to pursuing organizational goals have been channelled into other things. In order resources to be considered slack, they have to be visible to the manager and deployable when the time comes. Yet, some resources are more visible and easier to recover, whereas others are not. Furthermore, different types of slack grant managers different degrees of discretion and flexibility. The more discretionary resources are, the wider the variety of situations/ contingencies they can be employed in or the broader the range of action tools managers is aimed with".* They indicated that there are four major functions for the organisational slack are follows:

1. as an inducement for organizational actors to remain within the system.
2. as a resource for conflict resolution.
3 as a buffering mechanism in the workflow process.

4. as a facilitator of certain types of strategic or creative behaviour within the organization.

Many researchers such as Damanpour (1987), Miller and Friesen (1982) highlighted the importance of slack to organisational innovation and indicated that it should be considered when examining organisational innovation. While Nystrom et al (2002) indicated that the greater slack provides organisation with more resources to adopt innovation, and these innovations may become consistent and continuous. Their results on the adopting of the imaging technology in USA hospitals shows that there is a positive relationship between the organisational slack and innovativeness. The questions used in this construct were adapted from Nystrom et al (2002).

Ruiz-Moreno et al (2008) studied the effect of moderating slack on the relationship between perceptions of support for innovation and organisational climate in Spanish SMEs. The researchers indicated from their findings that the relation between the different dimensions of organizational climate, perceptions of support for innovation and performance are determined and limited by the nature and variety of resources that the organization can bundle and apply to the maintenance and development of competitive advantages, according to the availability of organizational slack to be applied directly to organizational climate and perceptions of support for innovation

3.5.5 Pro-activity

Unsworth and Sharon (2003, p. 176) discussed the pro-activity and innovation stated that '*proactivity is about being self-starting and change-oriented in order to enhance personal or organizational effectiveness such as by making improvements to work procedures or using one's initiative to solve problem'*.

It can be said that an employee in organization who has a proactive behaviour could help in solving problems and facing the unpredictable circumstances.

Perez-Luno et al (2010), and Miles and Snow (1978) indicated that the pro-activity orientation reflects proactive behaviour in relation to participation in emerging industries, continuous search for market opportunities and experimentation with potential responses to changing environment. Perez-Luno et al (2010), and Miller and Friesen (1978) pointed out that the proactive orientation reflects proactive behaviour in relation to participation in

emerging industries, continuous search for market opportunities and experimentation with potential responses to changing environment trends. Perez-Luno et al (2010) in their study to innovation in Spanish firms found that there is a positive relationship between the pro-activity and number of internally generated innovations. The questions used in this research construct related to the pro-activity adapted from Perez-Luno et al (2010).

3.5.6 Environmental dynamism

The questions for this research have been adapted from the Perez-Luno et al (2010) study. Perez-Luno et al (2010) pointed out that dynamic environments are characterised by rapid change and innovation in the industry as well as the uncertainty or predictability of actions of competitors and customers. Chirani et al (2011) have studied the impact of the market conditions on the customers in both private and public organisations in Iran. The researcher found that the market facilitating conditions have a direct impact on innovation characteristics and also on the individual characteristics. Therefore it can be said in order for an organisation to be competitive it should adapt itself with rapid change in the surrounding environment. Perez et al (2010), Khandwalla (1977) and Miller and Friesen (1978) agreed in principles in their definition to dynamic environment as one characterised by a high rate of change and newness. While Zhou (2006) indicated that the dynamic environment firms should introduce new products to satisfy the requirements of their customers. Priem et al (1995) carried out a study on how the relationship between rationality in strategic decision processes and firm performance may be moderated by environmental dynamism. Results, based on a survey of 101 manufacturing firms in USA, indicate a positive rationality-performance relationship for firms facing dynamic environments, but no relationship between rationality and performance for firms facing stable environments.

3.5.7 Business level attitude toward IT adoption

The business level attitudes construct's questions were adapted from Frambach and Scillewaert (2002). Tornatzky and Klein (1982), Davis et al (1989) and Frambach and Scillewaert (2002) pointed out that innovation acceptance by individual is based on the beliefs and affects held on innovation, and these beliefs and affects reflected on the attitudes of the individual towards a particular innovation, Rosenberg and Hovland (1960), Le Bon and Merunka (1998) and Frambach and Scillewaert (2002).

It can be concluded that the individual attitudes towards to the innovation is a vital factor in adoption of an innovation. Abukhzam and Lee (2010) in their study to the attitude of workforce toward the workforce toward technology adoption indicated that workforce attitude is a very powerful enabler or a barrier towards the adoption of the new technology. They stated that 'understanding why a workforce adopts or rejects new technologies has proven to be one of the most challenging issues for organisations to exploit new technologies. Workforce perception of, and attitude towards, new technology is a crucial element in the implementation of new technology projects. If the workforce primarily considers the new technology will decrease work time/ process and its adoption will not affect their positions, then they will adopt it. However, if they perceive it as threat to their future jobs, then they will be likely to resist the adoption of this technology'

Parveen and Suliman (2008) studied technology complexity, personal innovativeness and intension to use wireless Internet using mobile devices in Malaysia among 301 users. The researchers found that there is significant positive relationship between personal innovativeness and perceived usefulness. The personal innovativeness here means as the willingness of an individual to try out any new information technology, Agarwal and Prasad (19989), or the person who are more innovative should be more positive in their beliefs about the technology , Parveen and Suliman (2008, p.3). The researcher also found that the personal innovativeness has a significant positive effect on the perceived ease of use. The behaviour intention and attitudes also has been found to a very important factor in using the e-learning by Korean students, Park (2009). Positive relationship was found between the behaviour intension and the e-learning.

Researchers such as Lakhanpal (1994), Thong and Yap (1995), Hussein (2009), Tan et al (2007) studied the business attitude toward innovation/IT adoption and found that there is a positive relationships between innovation/adoption and the attitude of users. However, Rose (2005) found that there is non significant relationship between the adoption and attitude toward the IT adoption of the 120 students used in his study in the USA.

3.5.8 Number of employees (organisation size)

In his discussion to effect of the organization size on innovation, Damanpour (1992) found from his 36 correlations of 20 published studies that there is a positive relationship

between the organization size and the innovation. In addition he also highlighted the effect of the moderating factors indicate that:

- Size is more positively related to innovation in manufacturing and profit- making organizations than in service and non-profit-making organizations;

- The association between size and innovation is stronger when a non-personnel or a log transformation measure of size is used, than when a personnel or a raw measure of size is used;

- Types of innovation do not have a considerable moderating effect on the relationship between size and innovation; and

- Size is more strongly related to the implementation than to the initiation of innovations in organizations

However, Lee and Xia (2006) have indicated that the relationship between the organisational size and the innovation has been considered to be an important factor in predicting the IT adoption. However, in their meta-analysis of 21 empirical studies found that the relationship between the organisation size and IT adoption is disturbingly mixed and inconsistent. They carried out 54 correlations derived from 21 empirical studies to examine the relationships between the size and IT adoption and also to examine the effect of six moderators on relationship between the size and IT adoption. They indicated that although the results show a positive relationship generally existed between the size and IT adoption, the relationship was found to be moderated by five variables: type of IT innovation, type of organisation, stage of adoption, scope of size, and type of size measure. They indicated that the mixed views about the relationship between the size and innovation can be explained by a lack of consideration of moderators.

Yao et al (2002) also studied the relationship between the organisational size and innovation. They examined the Asynchronous Transfer Mode (ATM) technology adoption in university settings to investigate if there is a statistically significant relationship between university size and ATM technology adoption. They found that that

there is significant evidence that there is a statistically significant relationship between university size and ATM technology adoption in university settings. They suggested that the organisational size can be served as a predictor of IT adoptions in other organisations.

Researchers such as Nystrom et al (2002), Malhotra and Sing (2007) carried out studies in USA (70 hospital –IT adoption) and in India (88 bank-Internet adoption) respectively and found out that there is a positive relationship between the organisation size and innovation and adoption of the internet respectively. While Salavou and Lioukas (2004) the relationship between the innovation and SMEs in 150 Indian organisations and found that there is negative relationship between the two variables. In other study Scupola (2003) studied the Internet adoption by 7 Italian organisations and found that there is non significant relationship between the SMEs size and the Internet adoption.

It can be concluded from the above studies that the majority of the published literature on the relationship between the SME size and innovation/adoption indicate that there is a positive relationship between the two variables.

3.5.9 Type of Business

A very interesting study has been carried out by Tan et al (2011) on 406 managers/owners of manufacturing and services SMEs in Malaysia to find out the effect of type of business as moderator on 7 innovation attributes (relative advantage, compatibility, trialability, observability, security, complexity and cost). The study found that compatibility is the only characteristics moderated by industry type. They interpreted that the ICT is adopted if it is compatible with the job responsibilities and value systems of the individuals as highlighted by Trornatzky and Klein (1982). They also related their results that the SMEs in their case might perceive that ICT adoption interrupts with their existing business processes rather than increases their efficiency and effectiveness which are the primary goals of the enterprises. In general, they concluded that the type of industry is *not a moderator factor*.

3.5.10 Time in business (organisation age)

Researchers such as Flanagin, (2000) Kimberly and Evanisko (1981); Murphy and Tan, (2003); Nguyen, et al (2003) suggest that the relationship between the organisation age and the innovation adoption is negative. It has been pointed out by Flanagin (2000);

Kimberly and Evanisko, (1981) that younger organizations tend to adopt innovations faster compared to older organizations. With regard to implementation and adoption, respectively, a study in Singapore carried out by Murphy and Tan (2003) found that younger travel agencies were more responsive to their e-mail quires and more likely to use branded e-mail addresses compared to the older travel agencies. However, Ismail et al (2009) studied the IT adoption in Malaysia food industry found a positive relationship between the company age and its IT adoption. Their study suggests that the older company, the more they accept the innovation. They didn't expect this result (they expected negative relationship), and made their comments that it a phenomenon in foodservice industry that merits in depth investigation.

3.5.11 Type of organisation

Researchers such as Lee and Xia (2006) and Al-Solbi (2006) found that the type of company I.e. (public/private/foreign) has an effect on the adoption. Al-Solbi found that the there is difference in the IT adoption between the public and private organisations in Saudi Arabia.

West and Lu (2009) have compared the private and public sector organisations in using the new technology. They compared the performance of the leading websites companies with US public organisation. In their evaluation they found that private sector outpplaced the public sector. They indicated that many argue that the private sector is more entrepreneurial and innovative than the public sector. West and Lu (2009,p.1) stated that 'commercial enterprises—responding to market pressures and the need to stay competitive—incorporate new technologies into their operations as a way to boost efficiency and productivity. In contrast, government agencies don't have customers in the traditional sense and aren't required to show a profit on their revenues. Most public departments have multiple constituents, such as voters, taxpayers, legislators, administrators, the media, advocacy organizations, and non-profit organizations' they found from their evaluation that the private sector is outpaced the public sector in technology innovation. They found that private sector is better than the public sector in interactivity, personalization, and language translation. However they found that the government agencies performed better than their commercial counterparts on privacy policies and disability access. Not surprisingly, the public sector performed highest in the areas concerning public privacy and security, which are subjects it cares about most.

It can be concluded that the private sector is profit oriented sector while the public non-profit oriented sector i.e. service-oriented sector.

3.5.12 IT department

Al-Solbi (2006) in his study to the e-readiness in Saudi Arabia has found that the availability of IT organisations enables the adoption and diffusion of the technology within these organisations. The availability of an IT department in organisation could help people to sort their technical problems and also it could follow up the development the IT sector and how to gain benefits from this development

3.5.13 Age of manager

Age of the owner/manager was found to be important in innovation and adoption of the new technologies in SMEs. For example, Hunter and Kemp (2004) found that younger ages of investors are more open and had positive attitudes toward adopting e-commerce. This is expected since the young people who used the new technologies in their childhood are more familiar with it than the older people. While Abbasi and Al-Mharmah (2003) in their discussion to the project management practice in Jordan found that the old management (managers) have negative approach toward the utilisation of the new technologies in Jordan organisations. Many researchers such as Daly and Kitchell (1995), Taylor (1975), Hambrick and Mason (1984), Burke and Light (1981) and Hung and Lo (2010) identified that there is a negative relationship between manager's age and innovation adoption.

Sun and Zhang (2006) reviewed the available literature and found that the impact of the age as a moderator variable on the following relationships as shown in Table (3-21) below.

Table (3-21): Age as moderator, Zhang (2006).

Relationship	Moderator	Result
Subjective norm –Perceived usefulness	Age	Weaker for younger users
Subjective norm- Behavioural intention	Age	Weaker for younger users
Perceived ease of use- Behavioural intention	Age	Weaker for younger users
Perceived usefulness- Behavioural intention	Age	Stronger for younger users

3.5.14 Degree

Bayo-Moriones and Lera-Lopez (2007) conducted a survey to 337 SMES of Spanish workforces to find out the factors affecting the ICT adoption. Their results highlight the need to study the different ICT separately as well as the importance of establishment size, multinational ownership, and high-skilled workforce in ICT adoption

An interesting study has been carried out by Hung and Lo (2010) in Taiwan industry. The study was aimed to study the relationship among business performance, CEO background and CEO ownership. One of the independent variables considered in here are: age, degree, education background, stock ownership, CEO/chairman nationality duality, and foreign degree. They found that there is a negative relationship between business performance and degree of the managers/CEO. They found that managers with higher degree achieve worse performance than managers with lower degree. They also found that foreign degree is insignificant to performance.

3.5.15 Speaking foreign language

Paul (2006) indicated that language is a very important factor in the Arab world preventing them from using the internet. This point is also highlighted by Global Reach (2004) and by Al-Solbi (2006) who studied the e-readiness in Saudi Arabia organisations. This is expected since many people do not understand other languages.

3.5.16 IT budget

In his study to the e-readiness Saudi Arabia organisations, Al-Solbi (2006) has found that availability of IT budget gives more options to the management to promote support IT programmes in Saudi organisations. Tan el al (2011) in their study to effects of the industry type on ICT adoption in Malaysian SMEs found a positive relationship between the Internet-based ICT adoption and the cost. This means that the higher the adoption the more the cost of investment. However, the researchers found that the industry type does not moderate the relationship between the adoption and the cost.

Goode and Stevens (2000) carried out a study on 245 IT adopters and 245 IT non adopters (Australian SMEs) to the World Wide Web (WWW) technology. They found non significant relationship between business size and the (WWW) adoption. Adopters tend to be younger yet more experienced with technology than non-adopters. Businesses that

made use of IT budgets and IT support units also tended to be adopters, however adoption did not rely on the existence of these two factors.

The availability of financial resources in a company is vital factor which helps in adoption and diffusion of IT systems. Ismail et al (2009) conducted a survey among 323 Malaysian foodservice companies in Kuala Lumpur and Selangor. The results of multiple regression analysis revealed that sufficient capital and company affiliation factors related significantly to adoption of basic IT applications. However, only the sufficient capital factor affected the implementation of advance IT applications.

3.6 Conclusions

The main conclusions are as follows:

1. A conceptual IT adoption model for the Libyan construction organisations has been derived for this research as shown in Figure (3-1). The derivation of the model is based on the important available literature in this field as explained earlier in this chapter, and also based on pilot study and on the information obtained from the Libyan managers in the interviews which were carried out by the researcher with those managers before designing the nodel constructs.

2. The model comprises of three main categories of variables. The first category is the IT adoption (dependent variable), the second category is the (independent variables) which include 9 factors and their variables: relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability and facilitating conditions. The third category is the (moderator variables) which include three types of sub-categories with 16 moderator variables. The first sub-categoris is related to the organisation variables which include: number of employees, type of business, time in business, type of company, IT budget and the IT budget. The second sub-category is related to manager variables which include: manager age, degree and ability of speaking foreign language. The third sub-category is related to the explorating variables which include: voluntariness, external orientation, achievement orientation, company slack, pro-activity, evvironmental dynamism and business attitude toward IT adoption.

3. In order to test the model a questionnaire methodology was devised to collect the required information related to this model as explained earlier. A toal of 260 vaild forms was used for this purpose.

4. Two packages of statistical programs were used to test the model. The first package is the SPSS for windows ver. 17. This program was used to find the relatioships between the the IT adoption and independent variables. The second program was MODPROBE which is compatible with SPSS package and was used to find the impact of the moderator variables on the general IT adoption model derived in this research. This will explained in detail in chapters 6 and 7.

5. Since there is little information about the IT adoption in Libyan construction organisations, this derived model will through the lights on the important aspects of the current situation in Libyan construction sector. This will help the decision makes to take the right decisions related to the support of construction industry in Libya.

Chapter Four: Research Methodology

4.1 Introduction

This chapter deals with the research methodologies used in this research. The main headings which have been included in this chapter are: importance of doing research, research philosophy, research approaches, the questionnaire strategy, the interview strategy, selected methodologies for this research and their development, and conclusions.

4.2 Importance of doing research

In order to develop and improve our understanding to the world around us research is vital in all aspects of our lives.

Kumar (2005) in his discussion on the topic of research stated that "research is undertaken within most professions. More than a set of skills, research is a way of thinking: examining critically the various aspects of your day-to-day professional work; understanding and formulating guiding principles that govern a particular procedure; and developing and testing new theories for enhancement of your practice. It is a habit of questioning what you do, and a systematic examination of the observed information to find answers, with a view to instituting appropriate changes for more effective professional service".

University of Bradford, School of Management website defines research as "a process of enquiry and investigation; it is systematic, methodical and ethical; research can help solve practical problems and increase knowledge". Collis and Hussey, 2003-cited in the University of Bradford, School of management website indicated that the purpose of a research includes the following:

- Review or synthesize existing knowledge
- Investigate existing situations or problems
- Provide solutions to problems
- Explore and analyse more general issues
- Construct or create new procedures or systems
- Explain new phenomenon
- Generate new knowledge
- or a combination of any of the above!

From the above explanation it is clear that research is important for any field to progress and develop by increasing the understanding of the environment surrounding that field.
This chapter deals with the methodologies to be used in carrying out this research. It will discuss the research philosophies, research approaches, research strategies, research strategies to be used in this research, credibility of the selected strategies, problems faced by the researcher in collecting data, selected sample and data collection, statistical tests to be used and conclusions.

4.3 Research Philosophy

According to Saunders et al (2003) there are three research philosophies and views that dominate the literature: positivism, interpretivism and realism. Saunders et al (2003) pointed out that all the three views have an important part to play in business and management. Three views are explained below:

Abdollahi (2007) indicated that the positivism approach was influenced by scientific discoveries made during the 18^{th} and 19^{th} centuries. The positivism approach built its belief on the natural science laws such as surveys, experiments etc which gives meaningful interpretations to the natural events. McNeil and Chapman (2005) indicated that positivism is a philosophical concept, and refers to a particular set of assumptions about the world and about appropriate ways of studying it. In general, positivists see 'society' as more important than the 'individual', because the individuals are born, take place in society and then die, but society continues largely undisturbed, the positivists also believe that as there are natural laws governing the behaviour of chemicals, elements, plants, animals, etc, so there are social forces or laws governing and determining the operations of the social world, McNeil and Chapman (2005). The researcher in this tradition assumes the role of an objective analyst, coolly making detached interpretation about those data that have been collected in an apparently value free manner. Remeny et al (1998) indicated that the 'the researcher is dependent of and neither affects nor is affected by the subject of research'.

In summary this philosophy depends on knowledge and treats social sciences research in similar way to that of natural sciences.

The second philosophy is called interpretivism, defined by Encyclo (2010) (online dictionary) by two ways as follows:

1. *"Refers to approaches emphasizing the meaningful nature of people's participation in social and cultural life. The methods of natural science are seen as inappropriate for such investigation. Researchers working within this tradition analyse the meanings people confer upon their own and others actions."*
2. *"Interpretivism` may refer to: Interpretivism - in Cultural Anthropology, the view that cultures can be understood by studying what people think about, their ideas, and the meanings that are important to them. Franz Boas is the founder of this particular school of anthropological thought. Interpretivism - in epistemology, the view that all knowledge is a matter of interpretation. Intepretivism - a sociological tradition, also known as interacts".*

Jamieson (2011) in her discussion to the differences between positivism vs interpretivism indicated that interpretivists believe the society cannot be treated as a science. He highlighted the point that interpretivists stress the ability of individuals to exercise control and choices over their actions and because everyone is different with different views and attitudes it is not possible to use scientific methodology to study society and in this case scientific approaches are not suitable of the study of society because the differences between the natural work and the social world.

Saunders et al (2003p. 84) stated that '*those researchers critical of positivism argue that rich insights into complex world are lost if such complexity is reduced entirely to a series of law-like generalisations'.*

Therefore it can be said that the difference between positivism and interpretiviism is that the positivism follows the natural science laws and the interpretiviism does not follow these law.

Examples of research strategies using the positivistic and phenomenological (interpretivisit) are shown in Table (4-1) below.

Table (4-1): Examples of using positivistic and phenomenological strategies

Positivistic	Phenomenological (Interpretivisit)
• Surveys	• Case Studies
• Experimental Studies	• Action Research
• Longitudinal Studies	• Ethnography (participant observation)
• Cross-sectional Studies	• Participative Enquiry
	• Feminist Perspectives
	• Grounded Theory

Source: Bradford University (2010)

Third philosophy is called realism philosophy. According to Saunders et al (2003), realism is based on the belief that a reality exists that is independent of human thoughts and beliefs. In social sciences and in the study of business and management this can be seen as indicating that there are large scale social forces and processes that affect people without their necessarily being aware of the existence of such influences on their interpretations and behaviours. McNeill and Chapman (2005) in their discussion to the reality indicated that social reality (construct) can be created through social interaction. It then, takes on appearance of existing independently of us, and is perceived as influencing our behaviour from outside.

From social research point of view the three philosophies mentioned above should not be look as one is 'better' than the others. The main issue here is how to find an acceptable answer to the research questions. As stated by Saunders et al (2003):
'Businesses and management research is often a mixture between positivist and interpretivist, perhaps reflecting the stance of realism'.

Saunders et al (2003) in their discussion to the research strategies indicated that there are eight research strategies which can be used by researchers are: experiment; survey; case study; grounded theory; ethnography; action research; cross-sectional and longitudinal studies; exploratory, descriptive and explanatory studies.
In social and management studies the most important methodologies which are usually utilised by researchers are survey and interviews, Saunders et al (2003), Trochim (2006), Kidder (1981), Ranjit (1999) and Sarantakos (1993). These are explained below.

McNamara, (2010) highlighted the fact that the main advantages for the researcher using questionnaire methodology are as follows.

- can complete anonymously
- inexpensive to administer
- easy to compare and analyze
- administer to many people
- Can get lots of data-many sample questionnaires already exist.

McNamara (2010) also pointed out that when want to fully understand someone's impressions or experiences, or learn more about their answers to questionnaires interviews methodology should be used. The researcher indicated that the main rewards of using the interviews methodology are as follows:

- get full range and depth of information
- develops relationship with client
- can be flexible with client

The survey strategy is associated with the deductive approach Saunders et al (2003), (this will be discussed in section 4.4.1 below), The survey technique is usually used to obtain great amount of data either by using questionnaire or interviews or both of them. According to Trochim (2006) surveys can be divided into two broad categories: the questionnaire and the interview. The questionnaire provides the researchers with the quantitative data, while the interviews provide the researchers with quantitative data. The differences between the quantitative and qualitative strategies are shown in table (4-2) below.

Table (4-2): Some differences between quantitative and qualitative research

		Quantitative	Qualitative
1	Role of qualitative research	preparatory	Means to exploration of actor's interpretations
2	Relationship between researcher and subject	Distant	Close
3	Researcher's stance in relation to subject	Outsider	Insider
4	Relationship between theory/concepts and research	Confirmation	Emergent
5	Research strategy	Structured	Unstructured
6	Scope of findings	Homothetic	Ideographic
7	Image of social reality	Static and external to actor	Proconsul and socially constructed by actor
8	Nature of data	Hard, reliable	Rich, deep

Source: Bryman (1993)

This research will use two methodologies (interviews and questionnaire) to get enough information about the subject under investigation.

4.3.1 Research credibility

The credibility of the research is a very important factor for any researcher doing research especially in social sciences studies, Miller (2010), QMSS e-lessons (2010), Saunders et al (2003). The credibility of the research is represented here by two factors, reliability and validity of the research measurements. According to QMSS e-lessons (2010) the two primary criteria of evaluation in social research measurement or observation are:

1- Whether we are measuring what we intend to measure.

2- Whether the same measurement process yields the same results.

These two concepts are validity and reliability. In brief it can be said that we want to use measurement tools that yield consistent responses when used multiple times, (this is reliability) and similarly we want questions that get accurate responses from respondents (this is validity), QMSS e-lessons (2010). These two concepts are discussed in more details below.

4.3.1.1 Research reliability

The general meaning of "reliability" comes from its adjective word "reliable". The common meaning of the world "reliable" is dependable, predictable. In research the

meaning of reliability is stability overtime, representatives across subgroups and equivalence across indicators, Neuman (2003). QMSS e-lessons (2010) stated that:

"Reliability is concerned with questions of stability and consistency - does the same measurement tool yield stable and consistent results when repeated over time. Think about measurement processes in other contexts - in construction or woodworking, a tape measure is a highly reliable measuring instrument."

Reliability has been defined by Miller (2010)

"as the extent to which a questionnaire, test, observation or any measurement procedure produces the same results on repeated trials. In short, it is the stability or consistency of scores over time or across raters. Keep in mind that reliability pertains to scores not people. Thus, in research we would never say that someone was reliable. As an example, consider judges in a platform diving competition. The extent to which they agree on the scores for each contestant is an indication of reliability. Similarly, the degree to which an individual's responses (i.e., their scores) on a survey would stay the same over time is also a sign of reliability".

From the above it can be said that the designed instrument for any research should be reliable, it represents the nature of the research and also it should give the same results whenever it has been used.

In order to go further in discussing the reliability, it has been decided to explore the types of the reliability that face any researcher carryout post graduate research.

The reliability of this research will be discussed in chapter five –Quantitative results analysis and design.

4.3.1.2 Factors affecting the reliability of research instruments

Kumar (2005) discussed factors affecting the reliability of the research instrument and pointed out that these factors are as follows:

- The wording of questions- a slight ambiguity in the wording of the questions or statements can affect the reliability of a research instrument as respondents may interpret the questions differently at different times, resulting in different responses.
- The physical setting- in the case of an instrument being used in an interview, any change in the physical setting at the time of the repeat interview may affect the responses given by a respondent, which may affect reliability.

- The respondent's mood- a change in a respondent's mood when responding to questions or writing answers in a questionnaire can change and may affect the reliability of that instrument.
- The nature of interaction- in an interview situation, the interaction between the interviewer and the interviewees can affect responses significantly. This is important in the repeat interview in which interviewees give different responses due to the change in the interaction between the interviewer and the interviewees and thus could affect the reliability.
- The regression effect of an instrument- when a research instrument is used to measure attitudes towards an issue, some respondents, after having expressed their opinion, may feel that they have been either too negative or too positive towards the issue. The second time they may express their opinion differently, thereby affecting reliability.

4.4 Research approaches

In general there are two research approaches available. These approaches are deduction approach and induction approach. The deduction approach or (testing theory) and induction approach (building theory) are explained below.

4.4.1 Deductive approach

The deductive approach is used in scientific research and it is also called 'testing theory' approach, Saunders et al (2003). Abdollahi (2007) pointed out that the research approach is deductive when a theory and hypothesis (or hypothesise) are developed and a research strategy is designed to test the hypothesis. Saunders et al (2003) also indicated that the important characteristic of the deductive approach is that there is a research to explain the causal relationships between variables. The second characteristic of the deductive approach is that concepts need to be operationalised in a way that enables facts to be measured. The third characteristic of this approach is generalisation. But this needs large sample to represent the whole population in field research. This approach owes to the positivism philosophy.

4.4.2 Inductive approach

In the inductive approach researcher needs to collect data and then build a theory from these collected data Saunders et al (2003). According to Abdollahi (2007), the research

approach is inductive when the data is collected and they theory is developed as a result of the data analysis and this approach owes to the phenomenology (interpretivisim) philosophy.

Comparison between the deductive and inductive approaches are shown in Table (4-3) below.

Table (4-3): The differences between deductive and inductive approaches

Deduction approach	Induction approach	Deduction approach applied to this research
Scientific principles	Gaining an understanding of meanings humans attach to events	Conceptual model has been developed built on the principles of relationships between variables
Moving from theory to data	A close understanding of the research context	When the model building was completed (theory) then a quantitative data was collected to test the model
The need to explain causal relationships between variables	The collection of qualitative data	Hypotheses were assigned to explain the relationships between the model variables (i.e dependent/independent/moderator variables).
The collection of quantitative data	A more flexible structure to permit changes of research emphasis as the research progresses	When the data was collected the causal relationships between variables were found by using SPSS software
The application of controls to ensure validity of data	A realisation that the researcher is part of the research process	Data collected from managers in Libyan construction industry. All the necessarily steps were taken to control the data collection.
The operationalisation of concepts to ensure clarity of definition	Less concern with the need to generalise	Every thing in the questionnaire was clarified and made it clear
A highly structured approach		The questionnaire is highly structured approach. It consists on predefined questions.
Researcher independence of what is being researched the necessity to select samples of sufficient size in order to generalise conclusions		The research in doing the questionnaire is independent and doesn't have direct impact on the data collection. Sample of 260 respondents is acceptable and therefore the research results can be generalised.

Source: Saunders et al (2003)

It can be seen that the main characteristics of the deduction approach from the inductive approach is that the first relies on the scientific principles and the second relies on the phenomenal characteristics.

This research will follow the deductive approach (i.e. positivism) due to the following reasons:

1. This is aimed to test theory (hypothesis) by using collected data from Libyan construction SMEs organisations.
2. This research is aimed to find relationships between variables specified in the designed model of this research.
3. This research uses both quantitative and qualitative data to test the design ICT model. This gives in depth understanding to the relationships between the variables included in the model.
4. The results of this research could be generalised to other organisations in African and Arab countries which have similar characteristics as the Libyan society. The sample size of 260 construction organisations will help Libyan government in understanding the current situation of the IT utilisation in Libyan construction industry.

In this research two research strategies were used, questionnaire and interviews strategies. These will be discussed in detail in section 4.7 after summarising the advantages and disadvantages of the two methodologies. The use of two methodologies gives the researcher the opportunity to explore the issue under research in more details. Cameron (2011) highlighted the importance of using Mixed Methods Research (MMR) and indicated that the MMR is often referred to as the third methodological movement and has witnessed a rapid rise in the last 10 years.

4.5 The questionnaire strategy

The questionnaire strategy usually involves a pre-designed set of questions to be asked by the interviewer (or researcher) to the interviewees. The questions should be designed to answer the project's problems under investigation.

The advantages and disadvantages of the questionnaire are shown below, Milne (1999).

4.5.1 Some advantages of questionnaires

The advantages and disadvantages of questionnaire methodology have been discussed by many researchers such as Kidder (1981), Ranjit (1999) and Sarantakos (1993). The researchers have agreed that the questionnaire methodology is useful for social and business studies. For example Denscombe (2002, p. 27) indicated that the advantages of the questionnaire methodology are: empirical data-based on read world observation, wide and inclusive coverage-large scale research, surveys lend themselves to quantitative data, and generally cost and time saving. While the disadvantage, Denscombe (2002, p.28) include: tendency to empiricism, detail and depth of the data, and the accuracy and honesty of responses.

Sarantakkos (1993, p. 159) discussed the advantages and disadvantages of the questionnaire methodology and these can be summarised below:

- Questionnaires are less expensive and time saving than other methods such as the interview methodology.

- They produce quicker results compared to the interview methodology which needs more time.

- It is convenient method; questionnaire can be completed at the respondents' convince.

- They offer greater assurance of anonymity.

- They help to avoid bias or errors caused by presence of attitudes of the interviewer (in the case of interview methodology)

- Questionnaire is a stable, consistent and uniform measure, without variation.
- They offer a considered and objective view on the issue, since the respondents can consult their files, and since many subjects prefer to write rather than talk about certain issues.
- The use questionnaire promises a wider coverage, since they can approach respondents more easily than other methods.
- They are not affected by problems of 'non-contact'.

4.5.2 Some disadvantages of questionnaire

Sarantakos (1993, p.159) also highlighted the deficiencies of the questionnaire methodology as follows:

- They do not allow probing, promoting, and clarification of questions
- They do not offer opportunities for motivating the respondent to participate in the survey or answer the questions.
- The identity of the respondent and the conditions under which the questionnaire was answered are not known. Researchers are not sure whether the right person has answered the questions
- It is not possible to check whether the question order was followed
- Questionnaires do not provide an opportunity to collect additional information while they are being completed. There is no researcher present, for instance, to make observations while the questions are being answered.
- Due to lack of supervision, a partial response is quite possible.

The researcher during distribution of the questionnaire took all the precautions to minimise the above mentioned deficiencies. In order to make sure that the people who answered the questionnaire forms are the right people, in advance contact was carried out with all the managers included in this survey. This was either directly or by using the contact via mobile/internet communication tools.

4.5.3 Pilot Study

The main aim of carrying out a pilot study is to refine the questionnaire and get a reliable and valid research instrument. In general the pilot study usually can be carried out as follows:

The first version of the questionnaire was given to three independent referees specialised in this area of research to check its contents, wording, clarity, and its suitability to achieve

the aims and objectives of this research. Their comments should be considered and the first draft should be amended by adopting all the comments, additions, omissions etc.

After the amendment had been carried out, the questionnaire was ready to be distributed to the selected sample. Saunders et al (2003:485) stated that the pilot test means "Small-scale study to test a questionnaire or interview checklist, to minimise the likelihood of respondents having problems in answering the questions and of data recording problems as well as to allow some assessment of questions' validity and the reliability of the data that will be collected".

In spite that the research questions used in this study IT model are based on the available literature, a pilot study was carried out in the preparation of the final questions. This includes intensive discussion with my supervisor and also with colleagues in the postgraduate studies (PhD and MSc students) in Glamorgan University. The intensive revisions to all the questions in the study model refined the questionnaire and minimise the ambiguity in the in first design version. When the researcher completed all the comments from his supervisor and his colleague students in the university, the questionnaire was sent to four referees in Libya. Those referees are: Dr Taher Galsue, Dr Farahat Graby, Dr Aiad Algalal and also to my brother Dr Abdullah ElKabeer. The feedback and comments from those referees who work in Libyan universities and organisations are very important producing the final revised questionnaire for its distribution to the manager in Libyan organisations. They revised both copies of the questionnaire (i.e the English and Arabic versions). In addition to their comments on the questionnaire, they indicated that this study is very important to Libyan organisations which work in construction industry in Libya. This gave me more encouragement to carry out this research with more enthusiasm.

4.6 Interviews strategy

The interview strategy is also a qualitative approach which provides the researcher with live and in-depth information related to the problem under investigation. In carrying out an interview Stewart and Cash (1978, p.111) recommended four criteria for the interviews selections as follows:

***First*:** does the interviewee have the information you desire?

***Second*:** is the interviewee available?

***Third*:** is the interviewee willing to give you the information?

***Fourth*:** is the interviewee able to transmit the information freely and accurately?

The interviews may take different forms such as face-to-face interviews (with individual or groups), or the interviews can be carried out by telephones or computer devices. Generally, in research strategies there are five different types of research interviews Cohen and Crabtree (2006) as follows:

4.6.1 Structured Interviews

The structured interviews sometimes called standardised interviews, which mean that the same questions are asked of all respondents, Kajornboon (2003). While Cohen and Crabtree (2006) have pointed out that the characteristics of the structured interviews are as follows:

- The interviewer asks each respondent the same series of questions.
- The questions are created prior to the interview, and often have a limited set of response categories.
- There is generally little room for variation in responses and there are few open-ended questions included in the interview guide.
- Questioning is standardized and the ordering and phrasing of the questions are kept consistent from interview to interview.
- The interviewer plays a neutral role and acts casual and friendly, but does not insert his or her opinion in the interview.
- Self-administered questionnaires are a type of structured interview.

4.6.2 Semi-Structured Interviews

According to Kajornboon (2003) semi-structured interviews are non-standardised and frequently used in qualitative analysis. While Cohen and Crabtree (2006) indicated that the characteristics of semi-structured interviews as follows:

- The interviewer and respondents engage in a formal interview.
- The interviewer develops and uses an 'interview guide.' This is a list of questions and topics that need to be covered during the conversation, usually in a particular order.
- The interviewer follows the guide, but is able to follow topical trajectories in the conversation that may stray from the guide when he or she feels this is appropriate

4.6.3 Unstructured Interviews

In this type of interviews there is flexibility to the interviewer to ask questions to the interviewee to collect more information related to the subject under research. Kajornboon (2003) pointed out that this type of interview is non-directed and is a flexible method. While Cohen and Crabtree (2006) pointed out that in developing the interviews whether using structured or semi-structured or unstructured interviews the development of interviews questions should consider the following points:

- the focus of your inquiry (research question)
- what you want to learn from the person you're speaking with
- how much time you have and the kind of access you have
- how much you already know about your question, and how to manage this knowledge

The characteristics of the unstructured interviews are as follows, Cohen and Crabtree (2006).

- The interviewer and respondents engage in a formal interview in that they have a scheduled time to sit and speak with each other and both parties recognize this to be an interview.
- The interviewer has a clear plan in mind regarding the focus and goal of the interview. This guides the discussion.
- There is not a structured interview guide. Instead, the interviewer builds rapport with respondents, getting respondents to open-up and express themselves in their own way.
- Questions tend to be open-ended and express little control over informants' responses.
- Ethnographic, in depth interviews are unstructured.

4.6.4 Informal Interviews

The characteristics of the informal interviews are shown below, Cohen and Crabtree (2006).

- The interviewer talks with people in the field informally, without use of a structured interview guide of any kind.
- The researcher tries to remember his or her conversations with informants, and uses jottings or brief notes taken in the field to help in the recall and writing of notes from experiences in the field.
- Informal interviewing goes hand-in-hand with participant observation.

- While in the field as an observer, informal interviews are casual conversations one might have with the people the researcher is observing.

4.7 Selected strategies for this research

In this research both quantitative and qualitative strategies have been selected. This means questionnaire and interview strategies. The questionnaire provides the researcher with quantitative data while the interviews provide in-depth rich data related to this research.

In her discussion to the research with mixed strategies Niglas (2000) indicated that many researchers' regard quantitative and qualitative approaches both useful and proper ways of going to study the social world. Niglas stated that:

"Although they see some major differences between quantitative and qualitative research they also see some important similarities between them and advocate the integrated use of different methodologies if this can advance our understanding about the phenomenon under the investigation. The proponents of this position are sometimes called pragmatists".

The above explanation highlights the benefits of using mixed methodologies.

Cameron (2011) highlighted the importance of using two methodologies as explained above. In this research the researcher will use the interviews (qualitative strategy) and the survey (quantitative strategy). The summary of the research strategies of this research is shown in Table (4-4) below.

Table (4-4): Summary of research strategies for this research

No	Research objectives	Research questions	Methodology	
1	to review, analyse and synthesise the current available literature (theories and models) related to the IT adoption and innovation in this field	How are the relevant theories and models connected to the IT adoption	Extensive and in-depth review of the available theories and models in the IT field.	**Qualitative**
2	to build up a conceptual model for this research to explore the relationship between the constructs of the model	Is there relationship between innovation constructs and IT adoption?	Additional literature review and intensive discussion with my supervisor and my colleagues. Pilot study and interviews with 26 managers	
3	To explore the internal and external barriers face the Libyan construction organisation	What are the barriers face the Libyan construction organisation	Interviews with 26 manager	

4	To determine the relationships between the innovation factors and IT adoption	What are the relationships between innovation factors and IT adoption	Statistical package SPSS for windows-using simple regression models of the sample of 260 managers	**Quantitative**
5	To determine the relationship between the IT adoption and innovation factors	What is the relationship between the IT adoption and innovation factors	Statistical package SPSS for windows , using multiple techniques for the sample of 260 managers	**Quantitative**
6	To explore the impact of moderator variables on IT adoption model	What are the impacts of the moderator variables on IT adoption model?	Using MODPROBE software and SPSS	**Quantitative**

4.7.1 Interviews methodology used in this research

In the interviews exercise six questions were designed to investigate the current situation of the IT in Libyan construction organisations. These are explained below.

4.7.1.1 Development of interviews questions

Six Questions were designed for to interview the managers of the Libyan construction industry. The main aim of the interviews was to get an idea about the current situation of the ICT in Libyan construction organisations. Face-to-face interviews provide invaluable information to the interviewer.

Six questions were designed and revised by the researcher and his supervisor and many Libyan colleagues to make sure they are clear and achieve the objectives of this research. The final versions of the six questions which were used in the interviews are shown below:

Q1: You know that there is a huge and rapid development in the field of Information and Communications Technologies (ICT), could you please tell me, what is your organisation doing i.e. its activities? And what type of hardware/software and areas of applications are currently in use in your organisation?

Q2: Do you rely mainly on the ICT systems which are available in your organisation? This means that do you get the most benefits from the ICT systems installed in your organisation in your daily lives activities?

Q3: Please let me know what are the internal barriers (i.e. those within the control of the organisations) which face the adoptions and implementations of the ICT systems in Libyan organisation?

Q4: Please let me know what are the external barriers (i.e. those not within the control of the construction organisations e.g. government policy) which face the adoptions and implementations of the ICT systems in Libyan organisations?.

Q5: Could you please tell me what are your new requirements from the ICT systems (i.e. new hardware/software) to improve the performance of current practices in your organisation?

Q6: Do you have suggestions on how to move forward to improve the current practices of the ICT in Libyan construction organisations?

The interviews questions were validated with my supervisor, my colleagues in the university and by 3 people panel in Libya. The panel consisted of: Dr Tahir Galzwes (Alzaweh University) , Dr Farahat Greaby (Al-Tahady University) and Dr Abdullah Alkabeer (Petroleum research centre). The panel also helped me in translation of interviews questions from English to Arabic.

4.7.1.2 Carrying out the interviews

Semi-structured interviews were carried out by the researcher between the beginning of September to the mid of November of 2009. A total of 26 interviews were carried out with the managers of 19 public organisations, 5 private organisations and 2 foreign organisations. These organisations are located in different parts of the country, 9 north of the country (in Sert and Mesrata), 4 south of the country (Sebha and Jefrah), 8 west of the country (Tripoli, Alzawyah, and Tajorah) and 5 in the east of the country (Benghazi). The sample consists of 19 public organisations, 5 private organisations and 2 foreign organisations.

4.7.1.3 Difficulties faced the researcher while doing the interviews

Unfortunately there are many difficulties faced by the researcher while doing his fieldwork. These difficulties faced by the researcher during carrying out the interviews (qualitative approach) and during the distribution and collection of the questionnaire (quantitative approach) are explained below.

As mentioned earlier, the interviews took two and half months, i.e. from beginning of September to the mid of November of 2009. This related to fact that Libya is very big country and the researcher needs to travel to different part of the country to carry out the interviews. This will give a clear idea about the situation of the ICT in Libyan organisations and what difficulties faced by these organisations.

The main difficulties faced by the researcher during carrying out the interviews are summarised below:

- Changing appointments: many managers gave appointments and then changed their minds. They alleged to have meetings or on sick leave. This has delayed interview schedule.

- Travelling in a very big country: In order to carry out the interviews the researcher needs to travel from Tripoli (the capital) to other cities. For example the distance between Tripoli and Benghazi approximately 1200 km, and the distance between Tripoli and Sebha around 700 km. This means that the researcher should travel long distances in the desert areas to carry out the interviews.
- Transport problems: The researcher used help from his older brother by using his private car to go to different cities around the country.

4.7.2 Questionnaire methodology used in this research

The second methodology used in this research is the questionnaire methodology 'quantitative methodology'. As it mentioned earlier that 400 questionnaire were distributed to the Libyan organisations working in construction industry. The process of developing the questionnaire is explained below.

4.7.2.1 Development of the questionnaire strategy of this research

The designed questionnaire in this study was based on the literature review published in the field of adoption and diffusion of the ICT systems in SMEs. Nevertheless, it is also based on the interviews outcomes which have been carried out by the researcher to managers of the ICT in Libyan organisations. The questionnaire was designed to include several sections related to the characteristics of the construction organisations, characteristics of the management, managers and also external variables included.

The questionnaire was designed to include four main sections as follow:

Part one: company characteristics:

This part was designed to collect information related to the following issues: size of the company (i.e. number of employees), location of the company, type of business, how long in business, type of company (i.e. public, private or foreign), and availability of an IT department in the company premises.

Part two: Manager Characteristics:

The information collected in this part are related to the title of the person who filled the questionnaire form, nationality, age, gender, degree, area of qualification, country of graduation, speaking foreign language, and a specific budget assigned to the IT system.

Part three: IT adoption factors:

This part contains 16 main factors and their variables (70 variables) which were found in the literature affecting the adoption of the IT in organisations.

These will be explained in detail in the IT conceptual model of this research in chapter four.

4.7.2.2 Sampling and sample size

The selected sample for a research should represent the whole population Cooper and Schindler (2011) stated that "the basic idea of sampling is that by selecting some of the elements in a population, we may draw conclusions about the entire population. A population element is the individual participant or object on which measurements is taken. It is the unit of study".

Cooper and Schindler (2011:p.364) identified the main reasons why researchers use samples in their studies as follows:

- Lower cost: The economic factor in any research is a vital factor affects the researcher decision. Cooper and Schindler (2011:p.365) pointed out that the advantages of taking a sample rather than a census are massive. This means that selecting sample to represent the total population is more reliable way in doing research.
- Greater accuracy of results: The sampling process gives accurate results. Cooper and Schindler (2011:p.365) indicated that more than 90% of total survey error in one study results from non-sampling sources and only 10% or less was from random sampling error. Sampling enables the researcher to control the research by better controlled supervision, checking the missing or wrong or suspicions information.
- Greater speed of data collection: Cooper and Schindler (2011:p.365) indicated that sampling's speed of execution reduces the time between the recognition of a need for information and the availability of that information.
- Availability of population elements: The population element is the individual participant or object on which measurement are taken. In this study the Libyan organisation which works in the construction industry are available.
- Sample versus census: Cooper and Schindler (2011:p.365) pointed out that the advantage of sampling over census studies are less compelling when the population is small and the variability within the population is high. They also pointed out that two conditions are appropriate for a census study: a census is (1) *feasible* when the population is small and (2) *necessary* when the elements are quite different from each other.

Denscombe (2002:p. 21)) stated that "*in order to generalise from the findings of a survey, the sample must not only be carefully selected to be representative of the population: it also needs to include a sufficient number. The sample needs to be adequate size".*

Random sampling was used to select the sample for this research. The reason for selecting random sampling which is called (probability sampling) is that this type of sampling means that every element in the population of interest has an equal and independent chance of being chosen, Schofield (2006:30). This study concentrates on the public, private and foreign organisation in Libyan construction industry and these were drawn from the Libyan national database.

A total of 400 questionnaires were distributed in the first week of February 2011 to the SMEs which work in Libyan construction industry. The questionnaire was distributed to most construction organisations in Libya. These organisations are located in the North, South, West and East of the country. The selected sample includes public, private and foreign companies. The reasons for selecting different locations and different types of companies are summarised below:

- This gives the opportunity for the researcher to investigate the adoption of the IT systems in different part of the country. This will help the researcher to understand and get a wide view related to the organisations characteristics, managers' characteristics and factors affecting the IT adoption the IT in different part of the country.

- The sample also included the public, private Libyan organisations plus the foreign companies which work in Libyan construction industry. This also gives the researcher a clear idea about the profiles of the organisations and managers in these three different types of organisations. it also will highlight the factors that considered by these different types of organisations.

- The data collected from different locations (i.e. north, south, west and east of the country) and different types of organisations (i.e. public, private and foreign organisations) gives the researcher the opportunity to compare the adoption in these mentioned locations and types of organisations.

The researcher distributed the questionnaire by hand, by post and by e-mail. The organisations which are located in the main cities were visited and given the questionnaire. While the organisations which were located in suburb of cities the post and the e-mail were used to send the questionnaire. Without help from friends who live/work in different part of the country the researcher couldn't do the distribution and collection of the questionnaire forms.

From 400 distributed questionnaire forms only 270 respondents were completed the questionnaire and retuned the forms. This means that respondent's rate is 67.5%, and this is a good respondent's rate. But unfortunately 10 managers were not answering all the questions in forms and these forms were discarded.

4.8 Conclusions

The main conclusions of this chapter are as follows:

1. It has been found in the literature that the questionnaire and the interviews are very useful instruments to be in the social and management studies, due to the cost quantity and quality of data and saving time, Therefore, a total of 400 questionnaires were designed based on the literature and also on the interviews findings were distributed to the Libyan construction organisations. Only 270 forms were completed and 10 were discarded because they were partly completed. Therefore the sample used in the analysis is 260 SMEs.

2. In order to refine the questionnaire and minimise the ambiguity, the questions were piloted by intensive discussion with my supervisor, colleagues in the university and by references in Libya.

3. There were many difficulties faced by the researcher during the field work. These are related to find the appropriate time for the managers to carryout the interviews in a very big country like Libya. In doing so the researcher needed to travel to the north/south/west and east of the country to do the interviews. In the questionnaire methodology the researcher got some help from his brother and colleagues/friends in Libyan in distributing and collecting the questionnaire forms.

4. The researcher believes that using both questionnaire and interviews (i.e. quantitative and qualitative) methodologies will enrich the research and explore all the relevant information required for this research.

Chapter Five: Preliminary Analysis of the Qualitative and Quantitative Results

5.1 Introduction

This chapter deals with the preliminarily analysis of the obtained data from both the qualitative (interviews) and from the quantitative (questionnaire) methodologies. It will include the analysis of the qualitative data (interviews with 26 managers) and also the analysis of the descriptive statistics of the quantitative data (questionnaire data obtained from 260 organisations). The main points which were included in this chapter from the interviews methodology were: profiles of the interviewed managers, questions used in the interviews, analysis of the interviews outcomes such as the types of software/hardware/activities, internal barriers face the organisations, external barriers face the organisations, organisations' requirements, suggestions for further development and issues not covered by the questions and highlighted by the interviewed managers.

The chapter also included the descriptive analysis of the results obtained from the questionnaire methodology. The main points which have been covered here are: the profile of the surveyed organisations and the profile of the managers, descriptive analysis to the dependent and moderating variables considered in this research conceptual model.

5.2 Interviews methodology and its findings

This section includes the findings from the interviews carried out to 26 managers in Libyan construction industry. In order to organise the presentation of this chapter and make easy for the reader to follow, it has been decided to divide it into three main headings as follows: the profiles of interviewed managers, the questions asked in the interviews, analysis of the interviews outcomes and conclusions.

5.3. Profiles of the interviewed managers

Semi-structured interviews were conducted with 26 managers who work in the construction sector. The interviews were carried between the beginning of September to the mid of November of 2009. The sample was selected from the Libyan database of organisations work in construction industry. The sample consists of 26 organisations, 19 public organisations, 5 private organisations and 2 foreign organisations. These organisations are located in different part of the country: 9 of them are located in the north of the country (i.e. in Sert and Mesrata), 4 in the south of the country (i.e. Sebha and

Jefrah), 8 in the west of the country (i.e. Tripoli, Alzawyah, and Tajorah) and 5 in the east of the country (i.e. Benghazi). Therefore, it can be said that the sample represents the whole organisations which work in the construction industry in Libya. This helps the researcher to get a clear idea about their utilisation of the ICT in their daily activities.

It was a very interesting exercise to see the managers face to face to explore the current situation of the Libyan construction organisations and their utilisation of the IT in their daily lives. The researcher found that most managers are interesting to conduct the interviews and to highlight the difficulties which face them while carrying their daily business works. These organisations were found to carry out different engineering activities such buildings, roads and bridges and contracting works.

5.4 Questions used in the interviews

The prepared questions used in the interviews were based on the literature (e.g., Rogers (1995), Lee and Kim(2004), Oladapo(2007), Walker and Peansupap(2006), Alam et al (2007) as explained in chapter 2 and also on the researcher experience and discussions with his supervisor and colleagues in Libya and here in the university of Glamorgan. The questions were carefully phrased and checked to be understood clearly by the interviewees. There questions were explained in detail in Chapter 4- 'Research Methodologies- Section 4.7.1.1, Development of the interviews questions'. The answers for each interview were recoded on a digital recorder and then translated as shown in appendix (D).

5.5 Analysis of the interviews outcomes

Easterby-Smith et al (1991) pointed out that qualitative research enables the researchers to get closer to the organisational members in order to get a clear picture about the subject under investigation. Then the researcher analyse the obtained data to draw out a meaningful themes and patterns. In the analysis of the interviews the pattern of themes and ideas were used for this purpose as explained below:

a. type of software/hardware/activities
b. internal barriers face the organisations
c. external barriers face the organisations
d. organisations' requirements

e. suggestions for further development

f. issues not covered by the questions and highlighted by the managers

These themes are explained below.

a. Type of software/hardware/activities

Most of the interviewed managers who work in Libyan construction industry indicated that they have different types of hardware such as desktop/laptop computers, printers/fax, internet; landline/mobiles phones and some of them have satellite phones. They also have engineering equipment related to aerial surveying and other engineering equipment. They also indicated that they have many software related to their business activities such as MS Office, AutoCAD, ETAB etc. They indicated that they rely on the technology in carrying out their daily business activities such as design, sending receiving documents via the internet and e-mail and communications with their business chain partners. Most of them indicated that they rely on the IT systems available in their company premises. Many of those managers highlighted the point that they have old equipment and old versions of software. They indicated that the technology world is changing rapidly and they need to cope with it. This is an interesting point which means that their attitudes toward the technology are positive.

In spite that they use the technology available to them; however, they have many obstacles/barriers which have an impacts impact on their performance. These barriers are classified as internal (i.e. within the organisation) and external barriers (beyond the control) of the organisation.

b. Internal barriers face the organisations

Most of the interviewed managers agreed that there are many barriers face the Libyan construction organisations. These barriers are summarised below:

- Shortage in national skilled workforce in the ICT field. As a result of this problem the Libyan construction organisations depend on the external expertises from the Arab world and from other foreign countries. The organisations usually use these specialised bureau and companies to solve technical problems and train Libyan national individuals.
- Lack of training courses

- Lack of availability of foreign skilled workforce in the ICT field.
- Security of the internet
- Lack of Libyan national engineers who have experience in engineering software related to the engineering sciences such analysis and design and modelling.

- Many managers indicated that some managers have conservative approach toward the adoption and spreading the ICT systems (they do not support and encourage the utilisation of the ICT in our daily activities). This point should be treated by appointing the appropriate person (preferably specialised in ICT) to deal with decisions related to the ICT technologies.
- Non-availability of laptop for the site engineers.
- Non-availability of the communication technologies for site engineers. This reduces our efficiency in carrying out our activities. This related to the fact that Libya is a very large country.
- Lack motivations and rewards for the employees to encourage them to use the new technology.
- Lack of training courses internally and externally in the field of the ICT.
- Limited authorities given to the junior managers. More power should be give to the middle managers to take decision related to the ICT systems in their offices.-the management should have the power to take decisions related to the ICT systems. This point highlighted by many managers. This means the centralization has a negative impact on the adoption decisions and this agreed with the literature, Sultan and Chan (2000) and Wan et al (2005). Sultan and Chan (2000) found that centralization in company software in USA has a negative impact on the innovation of the individual manager. While Wan et al (2005) studied the impact of the centralization in 71 companies in Singapore found that the relationship between IT adoption and centralization is negative.
- Many private companies prefer the old paperwork
- Speed of the Internet network is low (and sometimes cutoff completely). This makes very difficult for to send /receive documents via the Internet.
- Shortage of the Libyan national skilled workforce specialized in the ICT field. One manager said ‘We must rely on the national individuals rather than on the foreigners in this matter’.

- Lack of our national expertise in the ICT software related to the engineering businesses.
- There is no plan to put the suitable person in the right position. This is related to the fact that the main office sometimes imposes people who are not efficient and do not support ICT adoption. However, there are attempts to improve the situation.

c. External barriers face the organisations

Most managers indicated that in general the state is supporting the utilisation of the ICT in all the offices around the country. However, low awareness and education of the public on using the new technology needs to be tackled. The main barriers which have been indicated by the interviewed managers are:

- Poor communication between the main office and the branches: Many managers highlighted this problem especially in the desert areas where the network coverage is very poor.

- One manager of foreign company (Turkey) indicated that 'the external barriers are related to poor banking system, and low awareness and education of the public on using the new technology. Internet security is also an important factor in this regard. There are other problems related to the high imposed taxes on foreign companies. There is also an important problem related to high money related to renting of land to build foreign companies in near the construction sites.. There is another problem related to the delay in the schedule of payment for the completed works and also visa problems'

- Poor banking system, post office services and low awareness and education of the public on using the new technology.

- Many managers do not support and encourage the employees to use the IT in their activities. The state should punish manager/director who doesn't support the IT promotion

Most of above mentioned barriers which face the Libyan organisations were also highlighted by many researchers such as Rhema and Miliszewska (2010), Hamed (2009), and Hamdy (2007) in their study to the Libyan organisations.

d. Organisations' requirements

Our main demand is that we ask all our colleagues and employees to use this technology to develop themselves. Training is a vital factor in this issue.

- Many of the managers also require the need to upgrade IT systems continuously. They indicated 'this will help us to improve our performance and also to develop our employees' abilities on how to deal with the new versions of technologies'.

- They also suggested using modern scientific and practical management in their organisations. They indicated that the old style of management is not valid in these days.

- They also highlighted the point that should be more cooperation with foreign companies in the field of IT. This will help to increase their understanding to the technology benefits and also increase their abilities in their adoption and utilising the technology.

e. Suggestions for further development

Most of the managers suggested the following to develop the current situation of the IT in Libyan construction organisations.

- Improve and develop training system (internally and externally)
- contribution in conferences and seminars
- improve education of human resources.
- improve banking system.
- more financial support to the ICT
- Establishing department of R & D in the field of IT
- Delegating authorities from top to bottom management in decision taking related to the IT.
- The interviewed managers suggested that more efforts should be concentrated on the management and to develop it to be IT management to serve the organisations activities and their business partners and customers. The success in the management is

a vital factor in promoting the ICT system in any organisation. The top management should take a role in spreading the IT in the organisations.

- Quality of the top management is a vital factor in supporting the use of the ITC systems in any organisation.
- Create motivation and rewards schemes to encourage people to use the ICT systems.
- Create competitive environment in the organisations to encourage people to use the ICT systems.
- Engineers and consultants should keep in touch with the latest version of technology. This can be done be encouraging them to read research/papers/articles published in journals/magazines related to the ICT systems.
- Give more power to managers in branches (this is in case of main office has many branches around the country). The independency of the branches from their main office is a good idea (i.e. this means more power related to the ICT decisions should be given the junior managers in the branches). This could serve the spreading of the ICT systems in the organisation and encourage users to get most benefits from them.
- The interviewed managers' highlighted the need to input new expertises in their organisation.
- Top managers should be competent in ICT systems and should encourage people to use the IT in their organisations.
- The managers also highlighted the need to develop their abilities in the ICT field to compete with the foreign companies working in Libya.
- Developing the skills of our nationals in IT field rather than rely on the foreigners.
- Develop our educational curriculums in the field of ICT. This should start from the primary schools towards the universities and higher institutions. Hamdy (2007) and Rhema and Miliszewska (2010) studied the utilisation of the ICT in higher education in Libya and highlighted the point that Libya is lagging behind their other countries in its adoption to the ICT in higher education.
- More communication with national and international companies related to the ICT issues. From our experiences we found that the foreign companies are more organised and advanced in using the ICT systems in their activities compared with our national companies.

f. issues not covered by the questions but highlighted by the managers. These are summarised below.

- Most old managers do not support the IT adoption and utilisations. This is very important point and also confirmed by the literature, e.g. Hunter and Kemp (2004), Abbasi and Al-Mharmah (2003), Daly and Kitchell (1995). They indicated that the old age managers have a negative impact of the adoption and utilisation of the technology.

Centralisation of the decision powers related to the IT decisions. The centralisation is also highlighted by the literature e.g. Chan (2000) and Wan et al (2005) and Pierce and Delbecq (1976). Pierce and Delbecq (1976, p. 35) stated that '*adoption requires some formalization and centralization of decision making to decrease conflict, and implementation probably requires the focus of effort within functional authority to carry through innovation'*.

5.6. Descriptive Statistics of the independent factors and their variables

As clarified earlier that this research has nine independent adoption factors: relative advantage, compatibility, Image, ease of use, result demonstrability, visibility, trialability, facilitating conditions, and subjective norms. Each question was designed on six Likert scale as follows: 1= strongly disagree, 2= disagree, 3=slightly disagree, 4= slightly agree, 5= agree and 6= strongly agree. This gives the consistency between all independent questions considered in this research. In order to give a clear picture about the responses to theses adoption factors and their variables, it has been decided to take them one by one.

5.6.1 Relative advantage

This factor consists of six different questions as shown in figure (5-1, A1—A6), and each question was designed on six Likert scale of 1= strongly disagree, 2= disagree, 3=slightly disagree, 4= slightly agree, 5= agree and 6= strongly agree. These questions were asked to the managers who work in Libyan construction industry.

It is clear from figure (5-1, A1) that all the respondents believe that there is advantage from using the IT in their business activities. Their responses that (40.8% strongly agree), 50.4% agree, and 8.8% slightly agree believe that using the IT results in improving the quality of work they do. These results are supported by the interviews (qualitative) results. It is also clear from figure (5-2, A2 that the surveyed managers (43.5% strongly agree), (46.9% agree), and 9.6% believe that using IT improve their performance. In figure (5-1,

A3) also it is clear that the responses of the managers believe that using IT increases their effectiveness.

Figures (5-1, A4, A5 and A6) are related to the effect of the IT on control of work, productivity, and the general advantages respectively. All these mentioned figures indicate that the managers in Libyan construction organizations are aware of the relative advantage of using IT in their activities. This point is clearly highlighted by the interviews with 26 managers in Libyan construction industry. This means that both the qualitative and quantitative results are consistent in this regard.

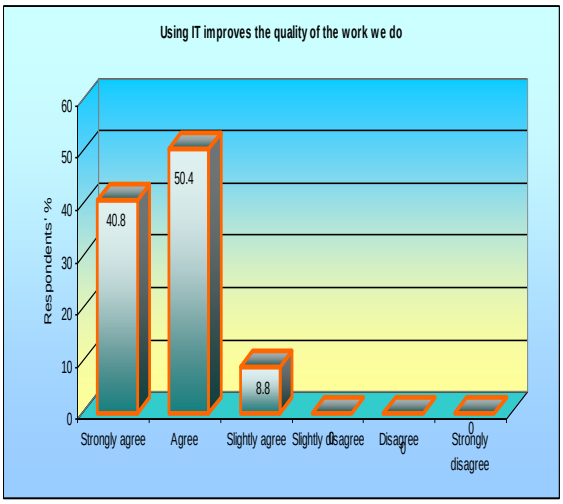


Figure (5-1): Relative advantage-A1

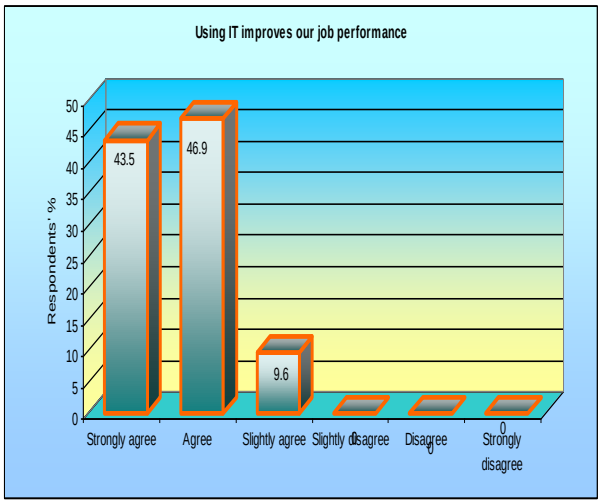


Figure (5-1): Relative advantage-A2

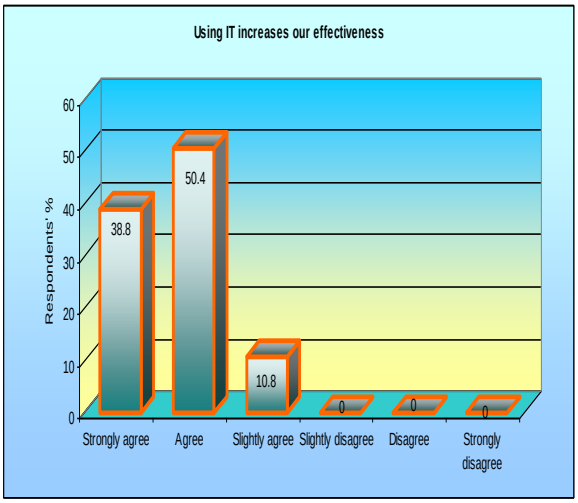


Figure (5-1)-Relative advantage-A3

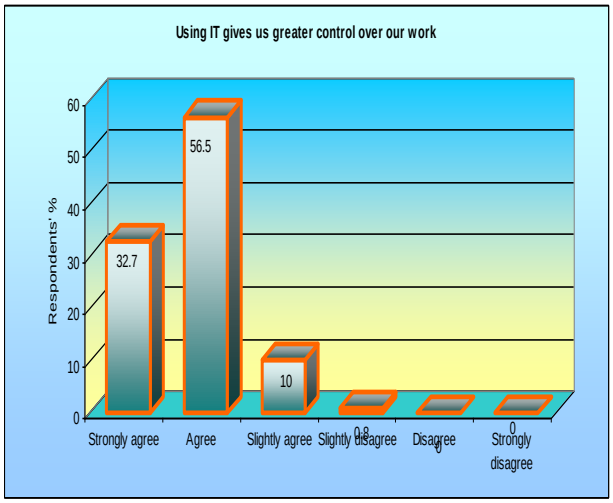


Figure (5-1)-Relative advantage-A4

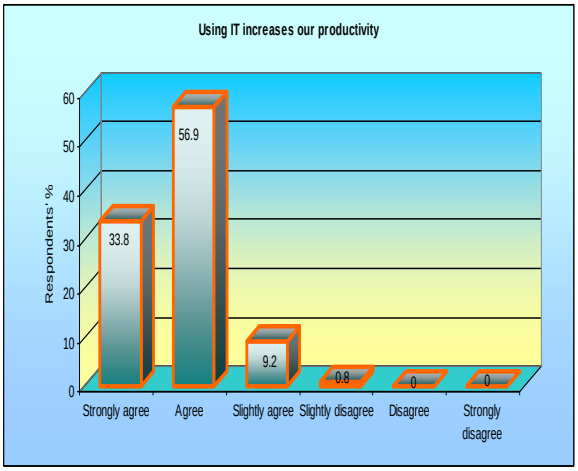


Figure (5-1)-Relative advantage-A5

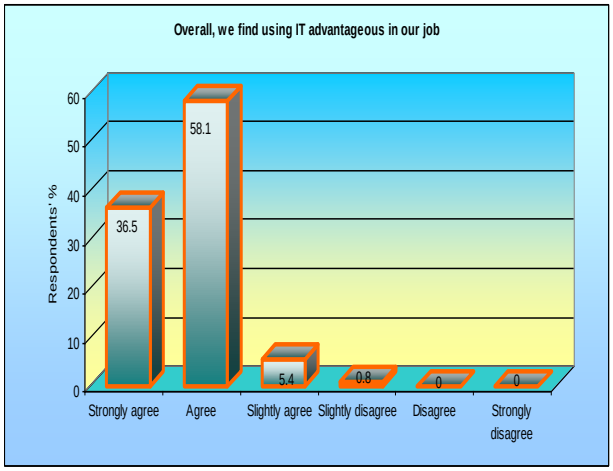


Figure (5-1)-Relative advantage-A6

5.6.2 Compatibility

The compatibility factor includes 4 questions shown in figures (5-2, B1-B4) and these are related to compatibility of IT with the type of work the organisations are doing, compatibility with current situation of the organisation, IT fits with their work and IT fits with the style of work they do.

It is clear from figure (5-2-B1 and B2) that almost all managers believe that using IT is compatible with all aspects of work done by organisations and also compatible with current situation. This gives an interesting impression about the belief of the managers in those surveyed organisations.

The questions in figures (5-2, B3 & B4) are related to fitness of using IT with the way they like to work and also with the style of work they do. It is very clear from both figures that all the managers believe that using IT fits with their work and its style.

The compatibility is also highlighted by the interviewed managers. They indicated that the technology is compatibility with their engineering activities such as design, drawing, calculations, sending/receiving documents and e-mail.

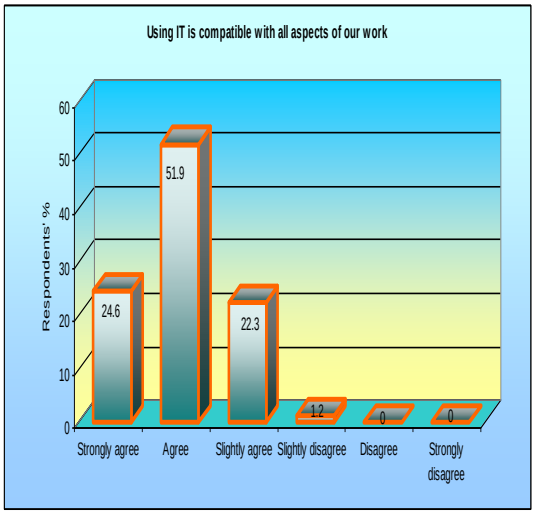


Figure (5-2): Compatibility-B1

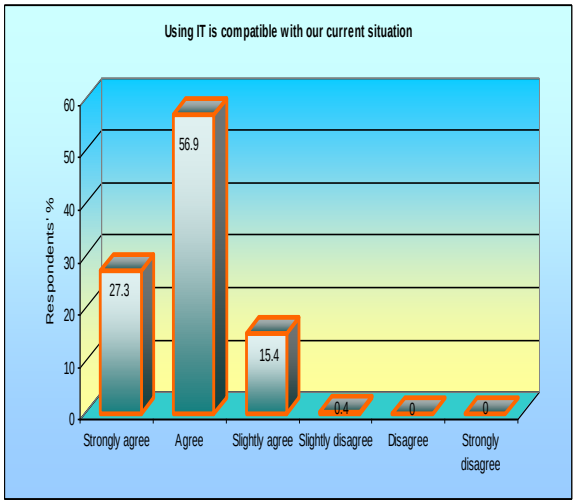


Figure (5-2): Compatibility-B2

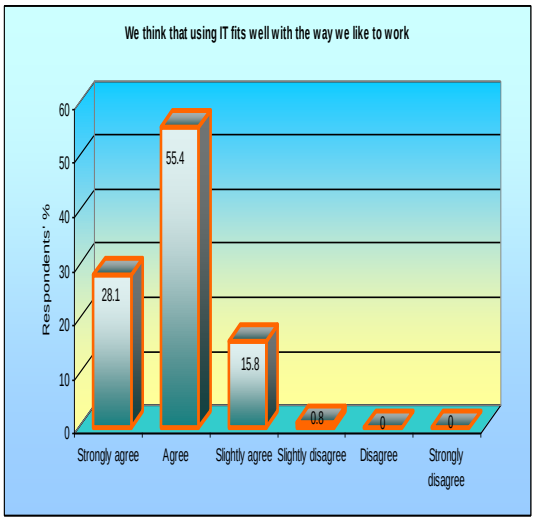


Figure (5-2): Compatibility-B3

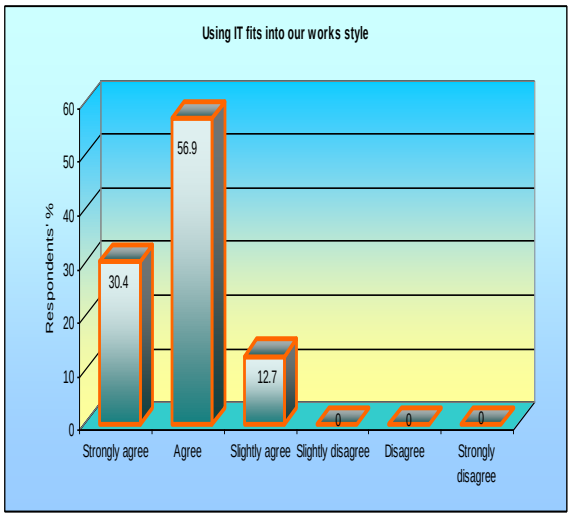


Figure (5-2): Compatibility-B4

5.6.3 Image

This adoption factor consists of 4 questions as shown in figures (5-3, C1-C4) below. Question in C1 is related to whether the use of the IT improves the image of the employees within the organisation. The figure shows that almost all managers believe that using the IT improves their images within the company. This is an important sign reflecting the feelings that using IT improves their images.

Question-C2 is related to the whether managers who use the IT have prestigious status in the organisation compared to those who do not use the IT. The majority of the managers

agree that people who use the technology have prestigious status compare to those who do not. This is a good sign encourages people to use the technology.

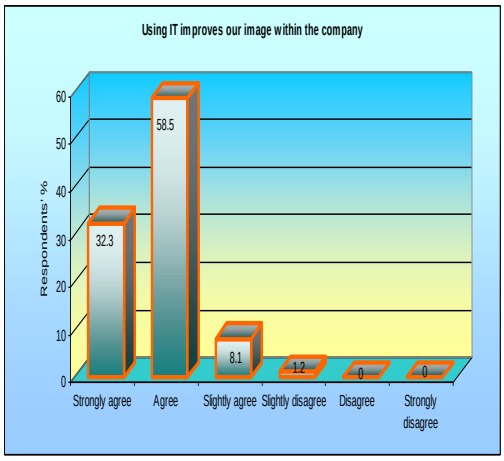


Figure (5-3): Image-C1

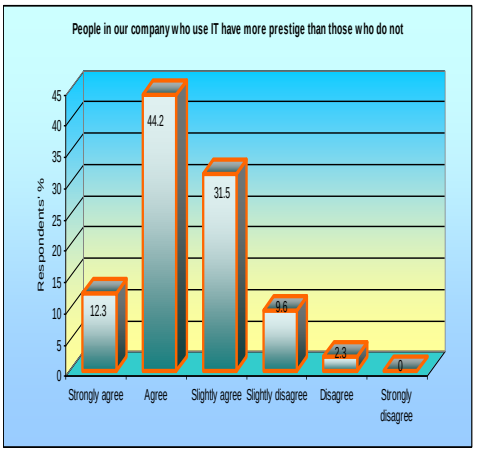


Figure (5-3): Image-C2

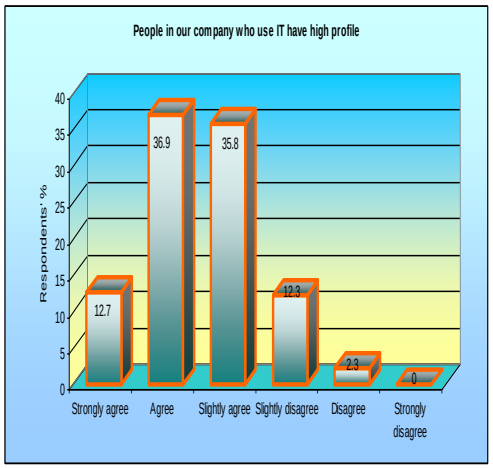


Figure (5-3): Image-C3

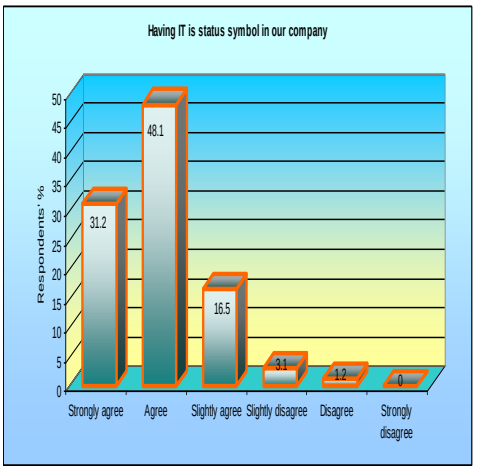


Figure (5-3): Image-C4

Questions C3 and C4 are related to the high profile of managers who use the technology and to the symbolic status of the company which use the IT respectively. The response for both questions are positive which indicate that the majority of the managers believe that those who use the IT have high profiles and also the company has symbolic status within the environment in which it works. The researcher in his interviews with the managers found that the interviewed managers are enthusiastic in using the IT and they suggested opening training courses in this field to update their technical knowledge to face the challenges in this century. The helps are reflecting their personal and their organisations images.

5.6.4 Ease of use

This adoption factor was designed to find out the managers' feeling on how ease of the use of the technology in their organisations. Six questions were included in this adoption factor as shown in figure (5-4, D1 to D6). Figure (5-4, D1) question is related to seek information about the cumbersomeness of the IT system. It is clear from the reply that 59.2% of the managers believe that the IT system is cumbersome. This means that the managers face some problems in using the IT system in their organisations. Figure (5-4, D2) indicates that more than 44% believe that using IT requires a lot of effort. While in figure (5-4, D3) it is clear that more than two third of the managers believe that using IT is a frustrating business. It is clear from the reply to questions (D1, D2 & D3) that there are obstacles face the managers in their business activities.

The above findings are consistent with the findings of the interviews which were carried out with 26 managers. Most of the interviewed managers indicated that they face difficulties in their use of the IT in their daily activities. These obstacles are related to the shortage of skilled workforce in the IT field, lack of training courses and lack of and seminar in the IT field. The managers indicated that many old fashion managers do not promote the use of the new technology.

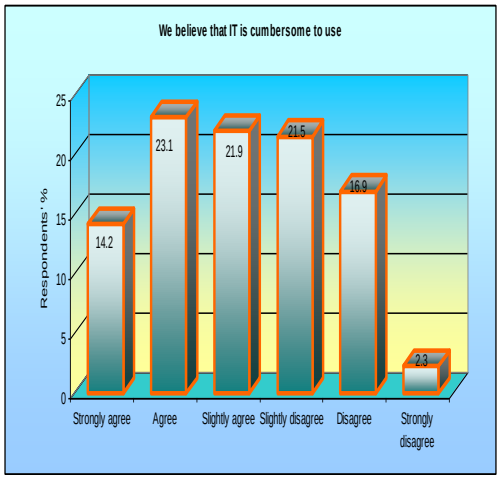


Figure (5-4): Ease of use-D1

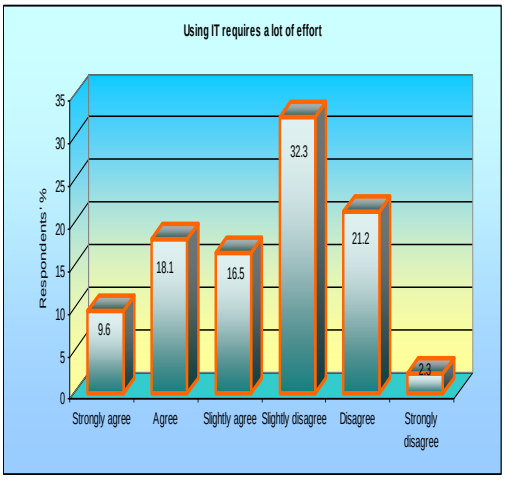


Figure (5-4): Ease of use-D2

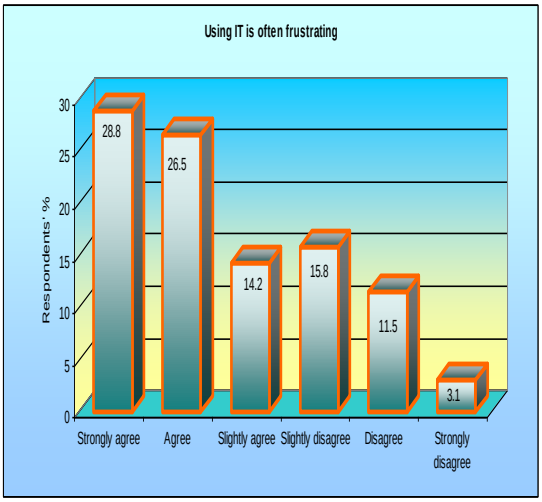


Figure (5-4): Ease of use-D3

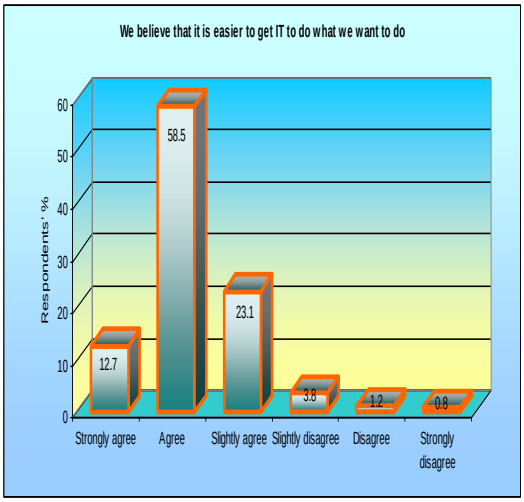


Figure (5-4): Ease of use-D4

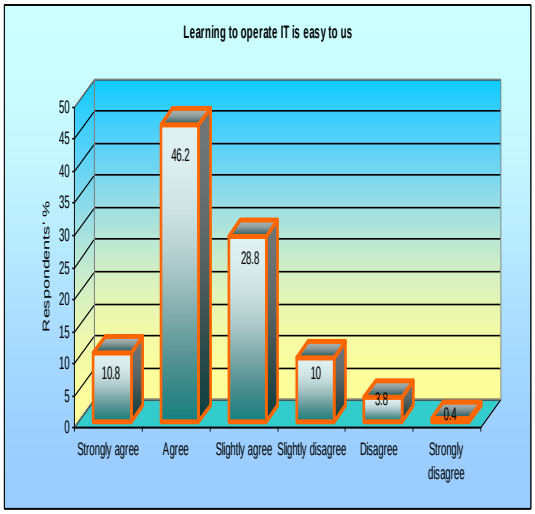


Figure (5-4): Ease of use-D5

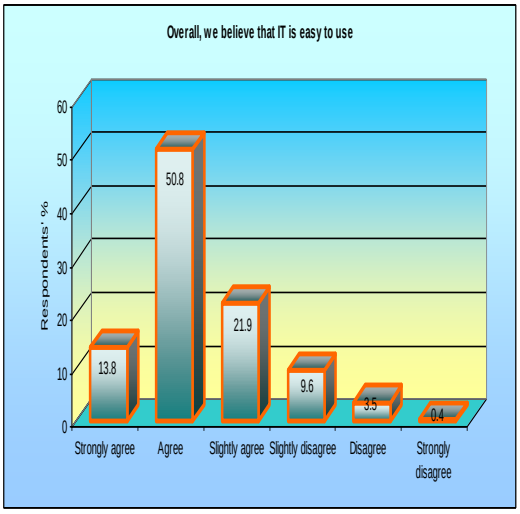


Figure (5-4): Ease of use-D6

Figure (5-4-D4 & D5) designed to find out how it is easy to get things done by using the IT. Question D4 states 'we believe that it is easier to get IT to do what we want to do' and D5 states that 'learning to operate IT is easy for us'. It is clear from the respondents reply to these questions that most respondents believe that they can use IT to do what they want to do and also it is easy for them to operate the IT system. Question D6, is related to the overall ease of use of the IT system. It can be seen from the figure (5-4, D6) that in spite of the obstacles the managers face the majority of them believe that they can easily use the IT. This is a good sign which indicates that the managers have some knowledge on how to use the technology. This knowledge could be limited to their professions.

5.6.5 Result demonstrability

This factor consists of four questions as shown in figures (5-5, E1 to E4) below. It is clear from the responses to these different questions that the majority of the surveyed managers are proud of the obtained results from using the IT and happy to demonstrate to the others the benefits resulted from that use of the technology.

The quantitative results here also come in agreement with the interviews findings. In the interviews the researcher found that most of the managers believe that the new technology have a great positive effect on their daily activities. This makes them proud to talk, explain and demonstrate to others the importance of the IT any business.

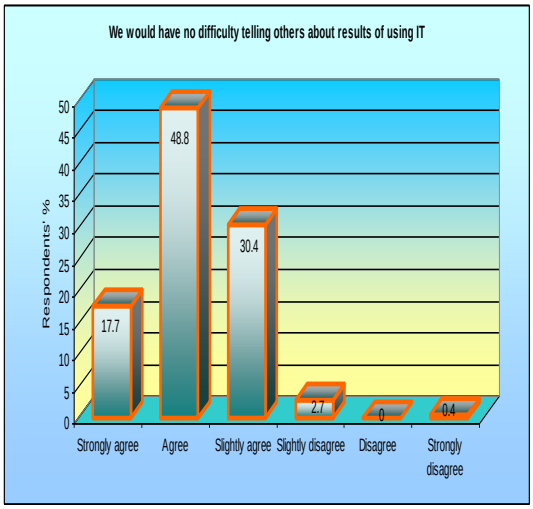


Figure (5-5): Result demonstrability-E1

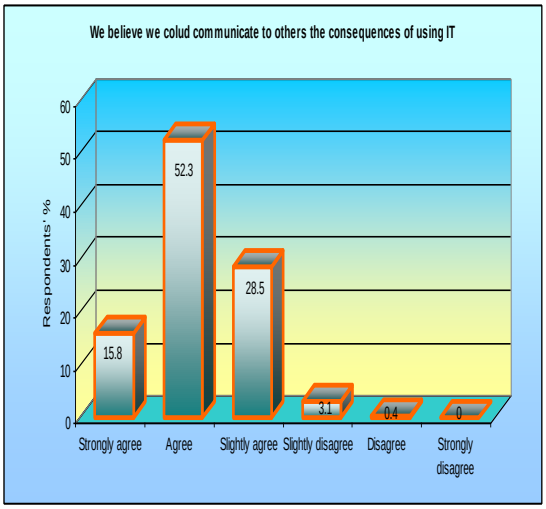


Figure (5-5): Result demonstrability-E2

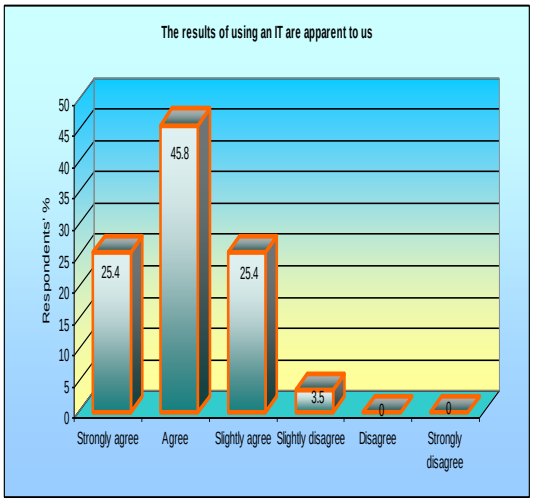


Figure (5-5): Result demonstrability-E3

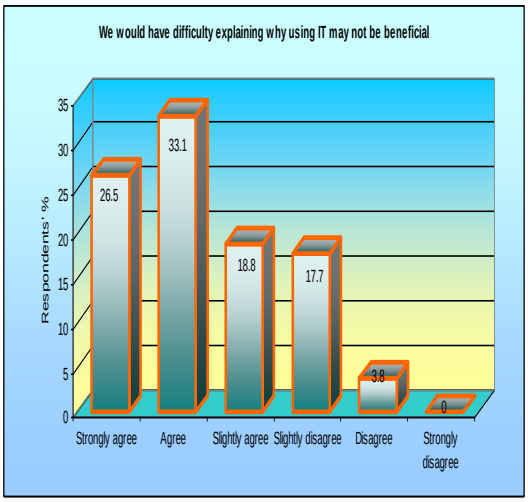


Figure (5-5): Result demonstrability-E4

5.6.6 Visibility

This factor consists of four questions as shown in figure (5-6, F1 to F4) below. It is clear from responses to the asked questions that the majority of the managers believe that the IT systems are visible in their company premises. However, in question F3 which is stated ' IT is not very visible in our company'. It is clear from the responses to this question that over 70% of them believe the IT systems are not visible in their company. This could mean that these organisations have limited number of IT systems fit within their requirements and have no spare computers for others to use. This also explains their responses to question D4.

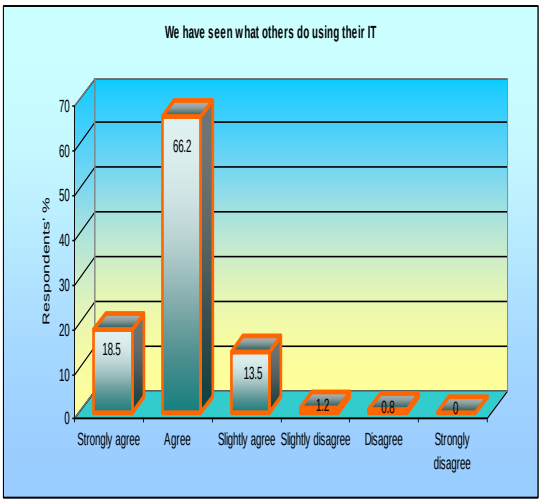


Figure (5-6): Visibility-F1

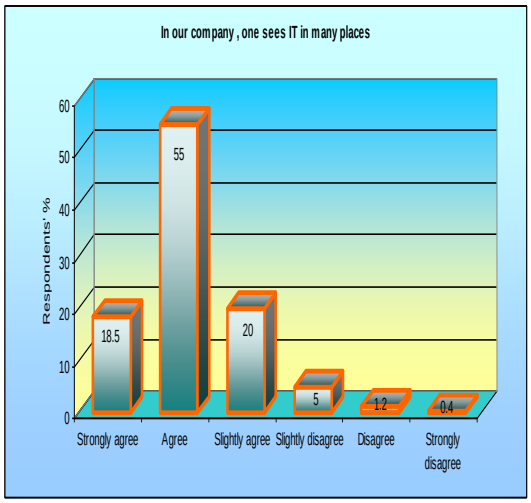


Figure (5-6): Visibility-F2

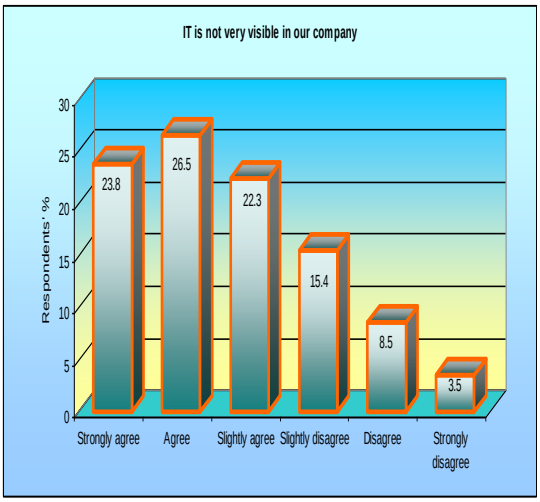


Figure (5-6): Visibility-F3

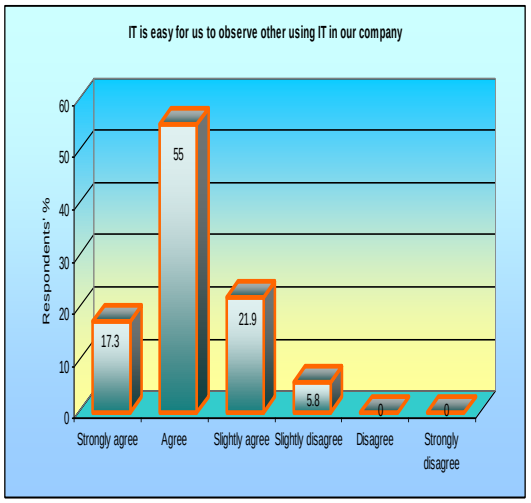


Figure (5-6): Visibility-F4

5.6.7 Trialability

This factor consists of four different questions as shown in figures (5-7, G1 to G4) below. It is clear from these figures that the majority of the managers positively responded to these different questions. This means that most of them believe that they have the opportunity to try various IT applications, they know where to go to get satisfactory uses of IT, have the opportunity to try an IT application before deciding to use it, and also have the opportunity to use the IT on trial basis to see what it could do. This is an encouraging sign which could help to get the proper technology to help them in their daily activities.

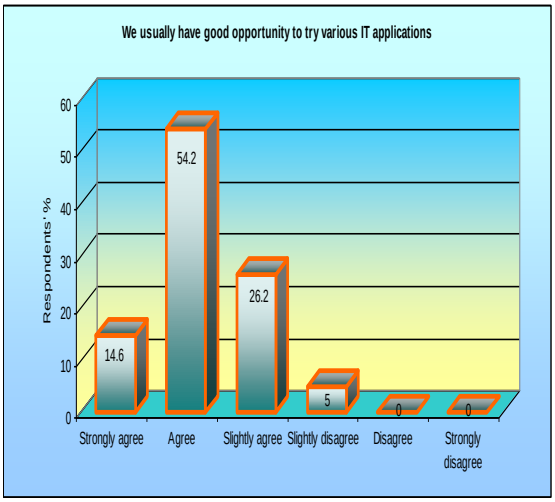


Figure (5-7): Trialability-G1

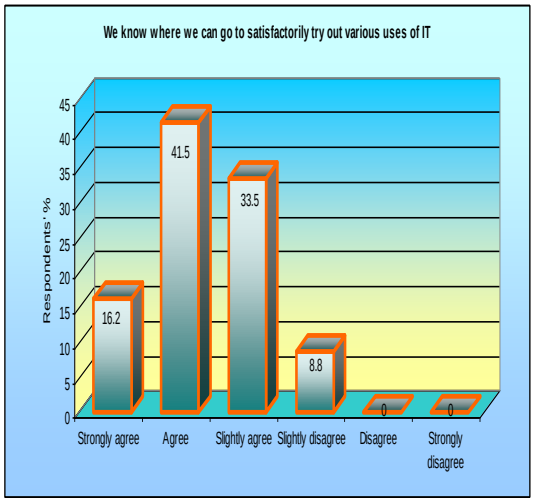


Figure (5-7): Trialability-G2

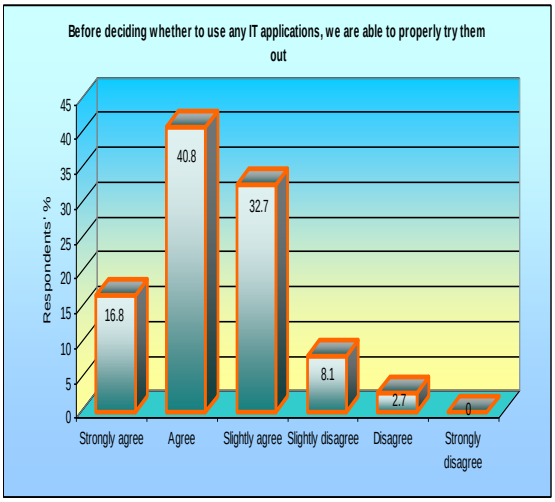


Figure (5-7): Trialability-G3

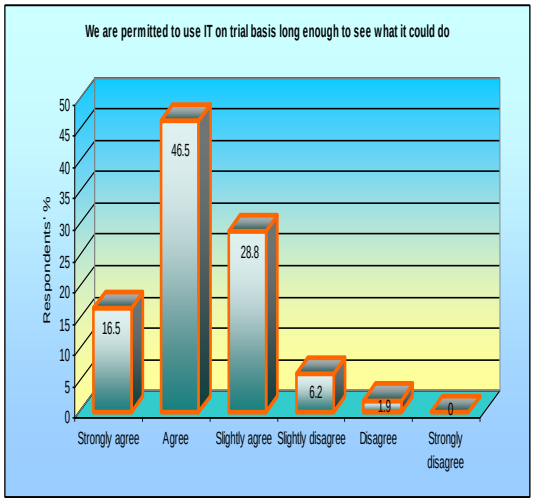


Figure (5-7): Trialability-G4

5.6.8 Facilitating conditions

This factor comprises of four questions as shown in figures (5-8, N1 to N4) below. These questions are related to the availability of resources necessary to use IT, knowledge, and assistance from the main office to solve any difficulties in using IT, and availability of knowledge sources such as books, manuals consultants to help in learning the IT respectively. It is clear from the responses that the majority of the surveyed managers responded positively to these questions. This means that the organisations have some degree of the required facilitating conditions to run their IT systems appropriately. But is spite of this they indicated in their interviews that have shortage in the skilled workforce in the field on IT.

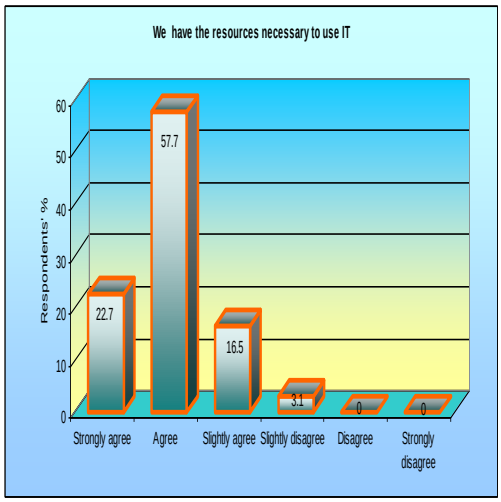


Figure (5-8): Facilitating conditions-N1

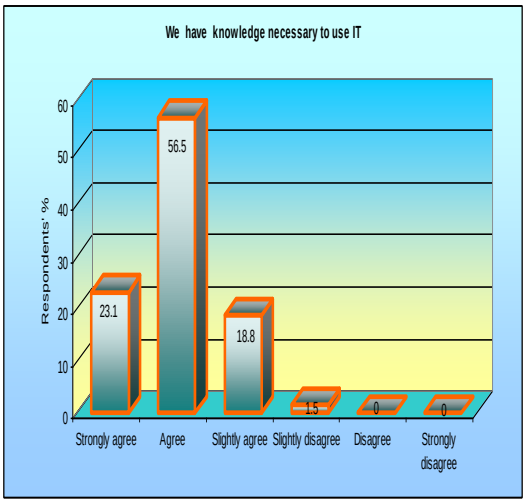


Figure (5-8): Facilitating conditions-N2

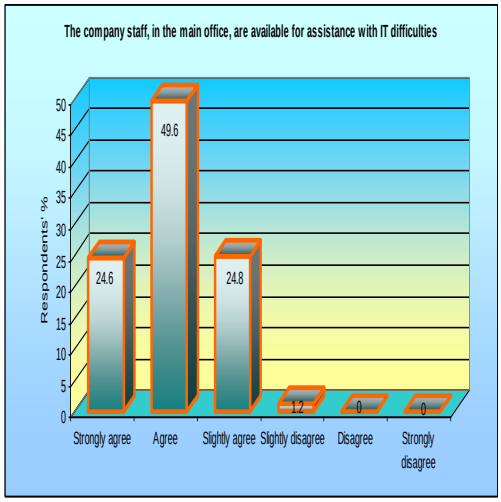


Figure (5-8): Facilitating conditions-N3

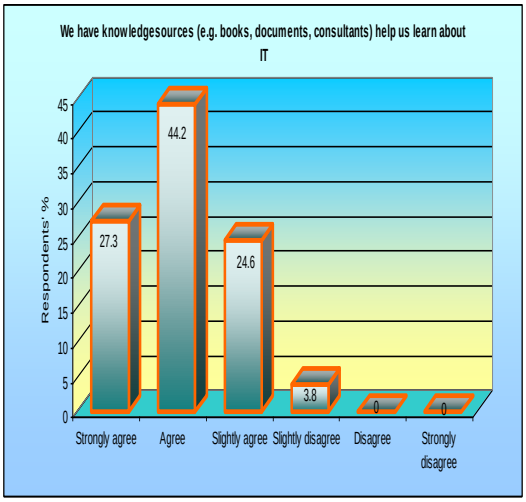


Figure (5-8): Facilitating conditions-N4

5.6.9 Subjective norms

This factor comprises of six questions as shown in figure (5-9, P1 to P6) shown below. These questions are related to external sources which affect the adoption of the technology. These different questions include: different leading companies within the supply chain use IT, trading partners within the supply chain use IT, majority of peer competitors use IT, the government actively promotes IT, IT adoption is supported by government grants and our employees encourage us to use the IT. It is clear from the responses to these mentioned questions that the majority of the managers were responded positively as shown in the above mentioned figures. But in the interviews managers indicated that they need more support from the government in promoting the IT.

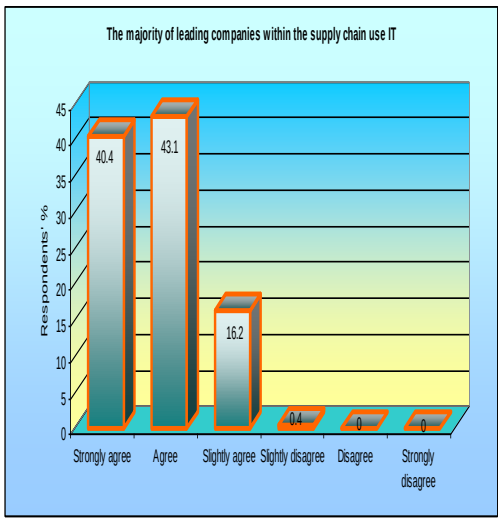


Figure (5-9): Subjective norms-P1

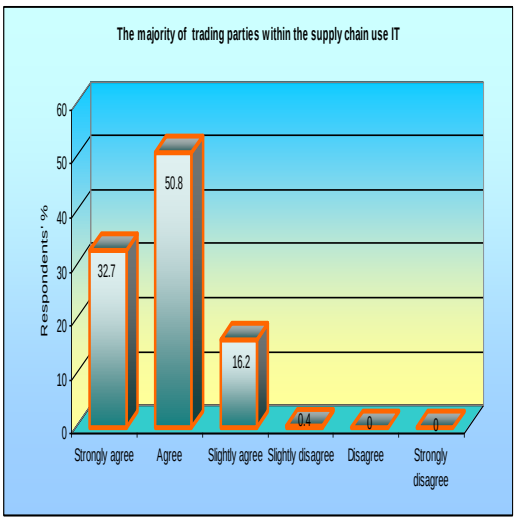


Figure (5-9): Subjective norms-P2

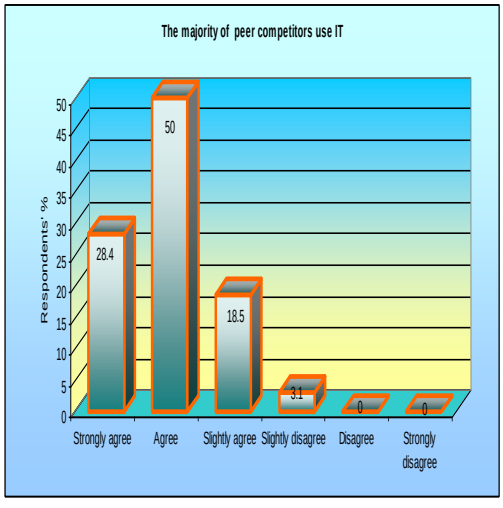


Figure (5-9): Subjective norms-P3

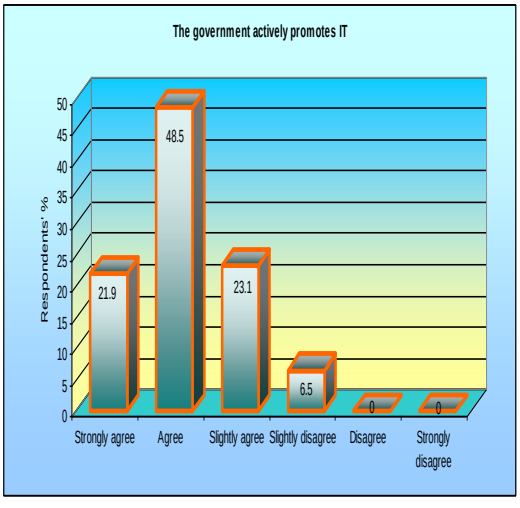


Figure (5-9): Subjective norms-P4

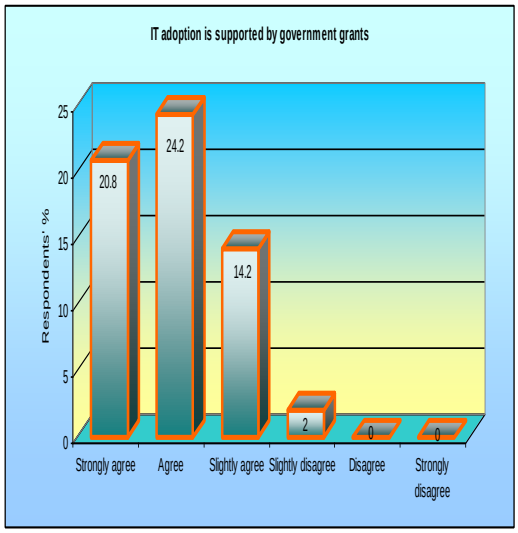


Figure (5-9): Subjective norms-P5

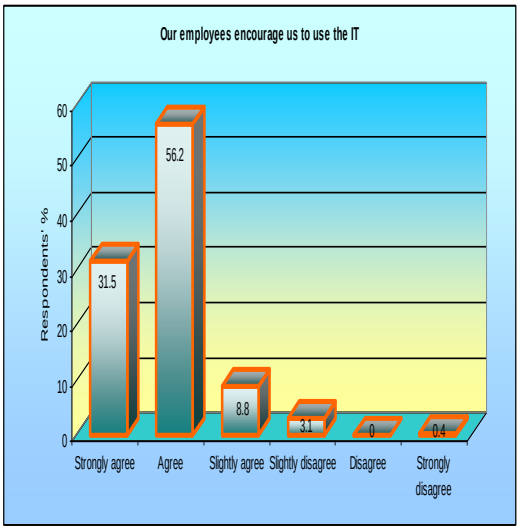


Figure (5-9): Subjective norms-P6

5.7 Descriptive Statistics of the dependent variable.

This section will concentrate on the explanation of the dependent variable which has been used in this study. It will discuss the derivation of the dependent variable, statistical description to the questions involves in achieving the dependent variable.

The responses of the managers to the software they use in their business activities are shown in figure (5-10) below.

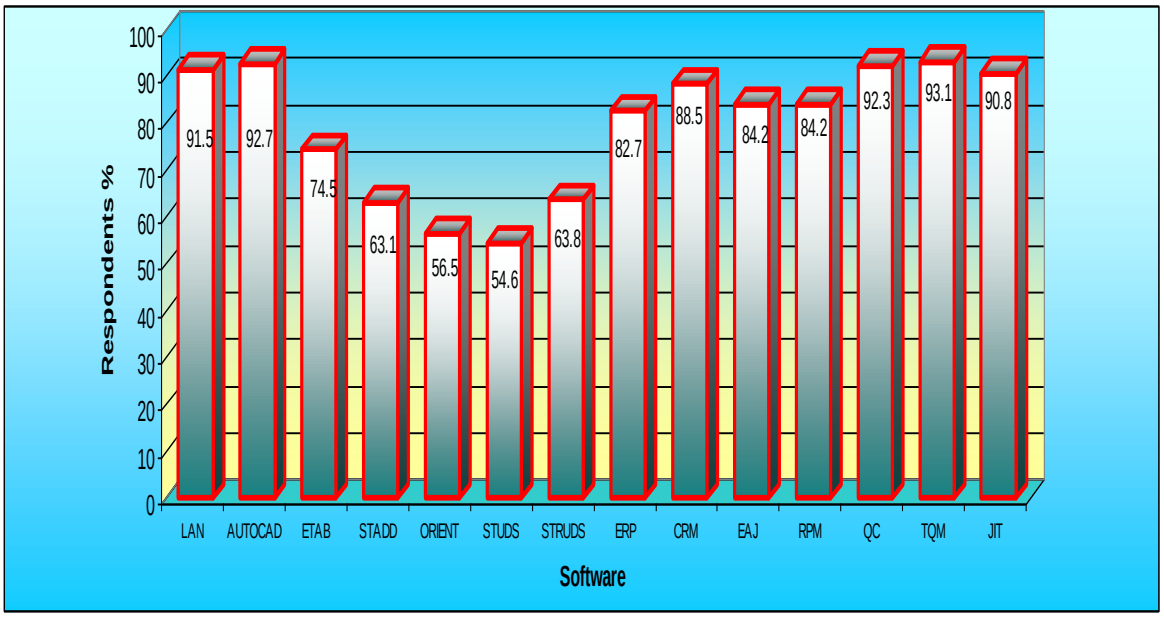


Figure (5-10): Software used by the surveyed organisations

Figure (5-10) shows that all the software has been used. The Figure also shows that total quality management (TQM) and AutoCad software are the most software been used and STUDS the least software been used. In general it can be said that all engineering software have been used. This is related to the nature of the technical activities carried out by the Libyan construction organisations.

5.7.1 Deriving of the dependent variable

The dependent variable here is **'IT adoption'** and was calculated as follows:

IT adoption= adoption of LAN*Skills level of using LAN+ adoption of AUTOCAD* Skills level of using AUTOCAD + adoption of ETAB* Skills level of using ETAB + adoption of STADD* Skills level of using STADD + adoption of ORIENT* Skills level of using ORIENT+ adoption of STUDS* Skills level of using STUDS + adoption of ERP* Skills level of using ERP + adoption of CRM* Skills level of using CRM + adoption of EAI* Skills level of using EAI+ adoption of RPM* Skills level of using RPM + adoption of QC* Skills level of using QC + adoption of TQM* Skills level of using TQM + adoption of JIT* Skills level of using JIT. (5-1)

The principle on which the IT adoption is calculated depends on two questions asked to the managers:

The first question is related to the use of the software: Do you use the following software? Yes=1 and No=0

The second question is related to the rate of use (i.e. skills). Used with little skills=1, used with moderate skills=2 and used with extreme skills =3.

For a specific software, when the responses to the above two questions multiplied the result represents the IT adoption of that software. Therefore, for a number of software the results should be added to get the overall IT adoption. This is illustrated below:

If Adoption of AutoCAD = 0 then the skill of using AutoCAD is irrelevant and hence the product is nil.

If adoption of AutoCAD = 1 but the skill of using AutoCAD is 0, then the product is nil.

If adoption of AutoCAD =1 and the skill of using AutoCAD is 1 (low), then the product is 1*1 = 1

If adoption of AutoCAD =1 and the skill of using AutoCAD is 3 (High), then the product is 1*3 = 3

5.8 Descriptive Statistics of the moderator factors and their variables

In the previous sections descriptive statistics of the independent variables and the dependent variable have been discussed.

The sections below deal with the descriptive statistics of the moderator variables used in this research. The moderator variables here include selected variables of the organisational and managerial variables plus the IT adoption factors. Therefore, the following sections include descriptive statistics of the organisation profiles, descriptive statistics of the manager profiles and descriptive analysis of the of the IT moderator factors.

5.8.1 Descriptive analysis of the surveyed organisations.

The descriptive analysis of the surveyed organisation includes number of employees, location of the HQ, type of business runs by the organisation, time in business (i.e. age of the organisation), type of organisation (i.e. public/private/foreign), and having an IT department.

5.8.1.1 Number of employees

The sample size used in this survey is 260 organisations. The minimum number of employees is 19 employees and the maximum is 13000 employees (in great river organisation) and the mean and standard deviation are 830.53 and 1325.763 respectively as shown in Table (5-1) below. The number of employees in categories is shown in Figure (5-11) below. It can be seen from this figure that the majority of surveyed organisation (>65%) have number of employees between 1-600 employees and 25% have number of employees more than >1000. This gives an opportunity to the researcher to investigate the effect of the number of the employees on the IT adoption in the surveyed organisations.

Table (5-1): Number of employees

Descriptive Statistics

	N	Range	Minimum	Maximum	Mean	Std. Deviation
Number of empl.FIG	260	12981	19	13000	830.53	1325.763
Valid N (listwise)	260					

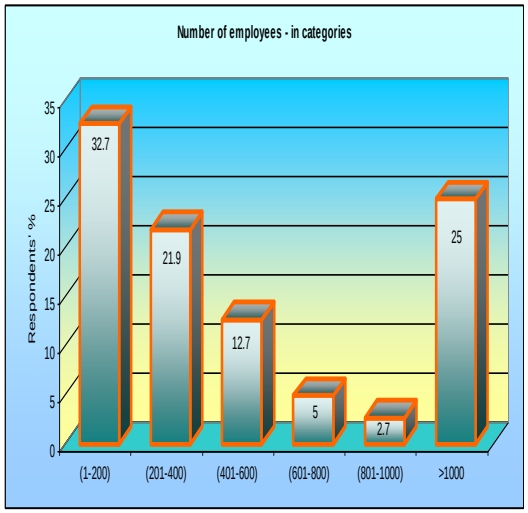


Figure (5-11): Number of employees

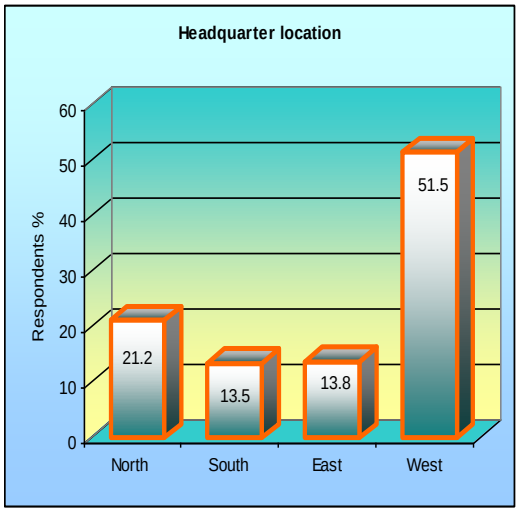


Figure (5-12): Location of HQ

5.8.1.2 Location of the organisation headquarter (HQ)

Location of the HQ of the surveyed organisations is shown in Figure (5-12) below. It is clear from the figure that more than half (51.5%) of the surveyed organisation are located in the west of the country. This is related to the reason that the west of the country includes the capital (Tripoli) and more business are located their HQ in the capital. The same figure also shows that 21.2%, 13.5% and 13.8% in the north, south and east of the country.

5.8.1.3 Type of business carried out by organisation

Type of business carried out by the surveyed organisations is shown in Figure (5-13) below. It can be seen from the above mentioned figure that the majority of the surveyed organisations are engaged in contracting (56.5%). This is expected since most businesses in construction industry in Libyan are related to contracting and executing construction projects. The other organisations engage in investment, construction, maintenance and consulting engineering.

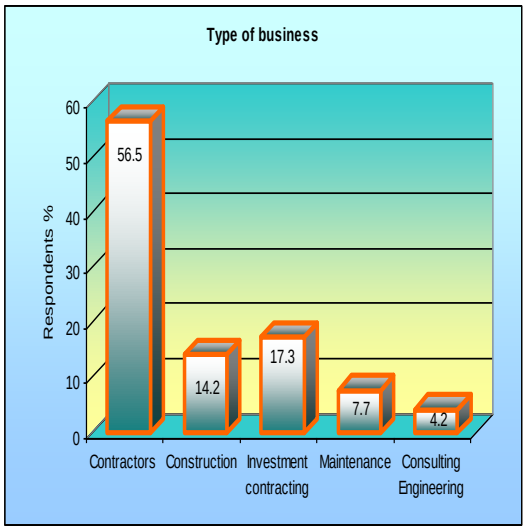


Figure (5-13): Type of business

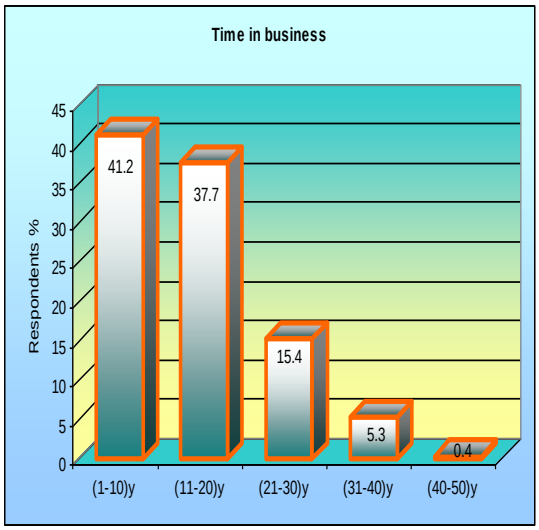


Figure (5-14: Time in business -categories

5.8.1.4 Time of the organisation been in business

Time in business of the surveyed organisations is shown in Table (5-2) and Figure (5-14) above. It seems from Table (5-2) that the minimum time in business is 4 years and the maximum is 41 years with a mean and standard deviation equal to 14.59 and 8.173 respectively. Figure (5-14) reflects that fact that the majority of the surveyed organisations have been in business for relatively reasonable time. The figure shows that 42.5% established between (1-10 years), 37.7% established in time between (11-20 years) and 15.4% established between (21-30 years). This might be related to the lifting of the sanction imposed on Libya by the UN in the past few years. The new economic environment helps in establishing new organisations. This variation in the time of establishment of the surveyed organisations (i.e. organisation age) gives the opportunity to the researcher to investigate its effect on the IT adoption in their businesses.

Table (5-2): Time in business

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Time-in-busi-FIG	260	4	41	14.59	8.173
Valid N (listwise)	260				

5.8.1.5 Type of organisation

The type of organisation is shown in figure (5-15) below. It seems from the mentioned figure that 50.8% of the surveyed organisations are private organisations, followed by 29.2% public and 20% foreign organisations. It can be said that the private organisations

taking the main role in Libyan construction industry. The foreign companies also constitute 20% of the working companies. This could help in developing the use of the IT systems in Libya.

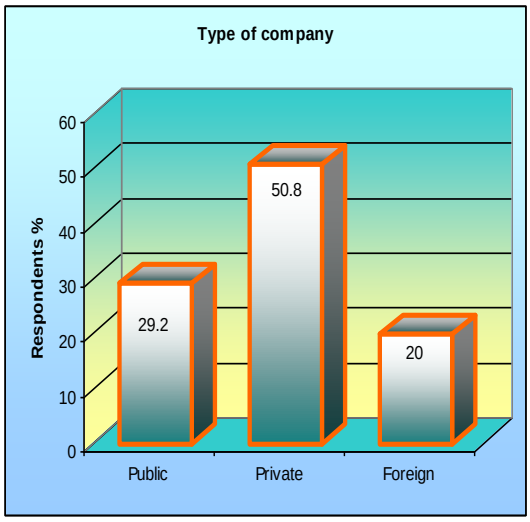


Figure (5-15): Organisation type

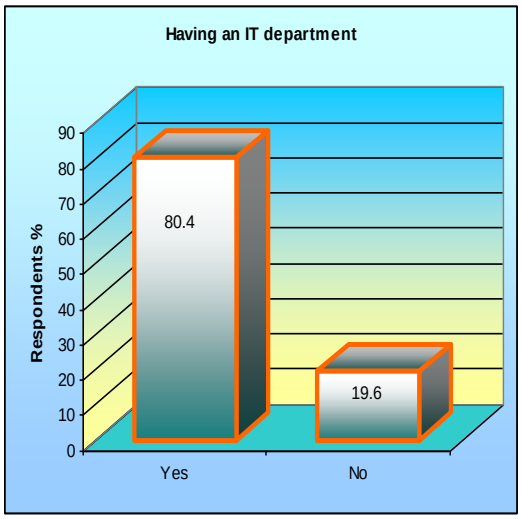


Figure (5-16): IT department

5.8.1.6 Having an IT department

This question is related to the availability of an IT department in the surveyed organisations. As shown in Figure (5-16) above, that 80.4% of the surveyed organisations mentioned that they have IT departments in their premises. This is an encouraging sign which helps in the adoption and diffusion of the IT systems within the employees of these organisations and also within Libya as a whole.

5.8.1.7 Having IT specific budget

This question is related to the specified IT budget within the organisation. It is clear from Figure (5-17) that the respondents to this question show that 71.5% indicated that they have specific budget to be spent on the IT projects. This is an interesting sign which shows that the managers are aware of the importance of the IT in their business activities.

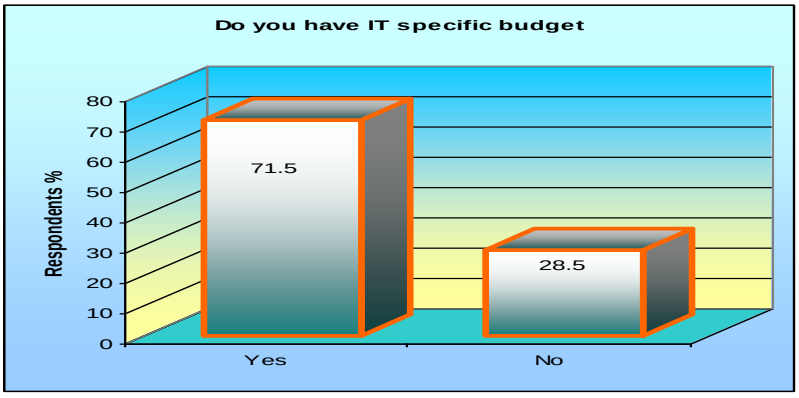


Figure (5-17): IT budget

5.8.2 Descriptive profiles of the surveyed managers

This section is related to the profile of the surveyed managers. It includes title of the manager, nationality, age, gender, degree, area of qualifications, country of graduation and ability of speaking foreign language.

5.8.2.1 Title in the organisation

Figure (5-18) shows the title occupied by the surveyed personnel in Libyan organisations. The results reveal that 36.9% are managers, 27.3% engineers, 20.4% chief executives/senior managers and only 7.7% for each of the architect and the financial officer. It can be said that the managers, engineers and chief executive are the majority who runs the organisations and because of this, it is expected that they are the decision makers in their organisations. As far as the IT adoption is concerned, this could promote the IT adoption if they are willing to take the right decision in this matter.

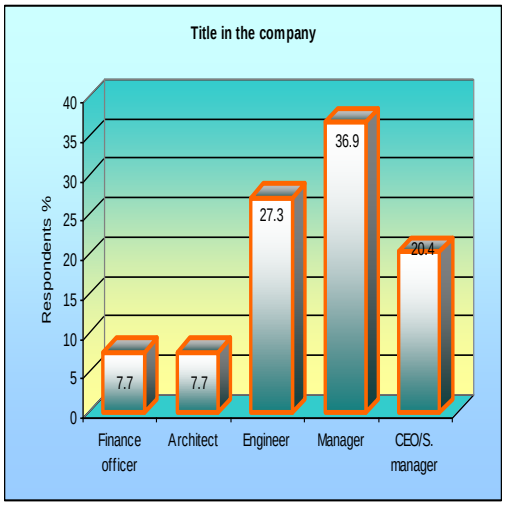


Figure (5-18): Title of manager

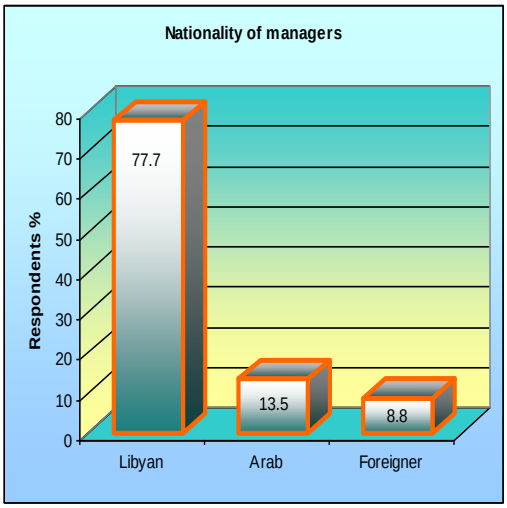


Figure (5-19): Nationality

5.8.2.2 Manager nationality

The nationality of the surveyed managers is shown in Figure (5-19). It seems from the above mentioned figure that the majority of the managers are Libyan national (77.7%), followed by the Arab (13.6%) and foreigners (8.8%). This is also a positive sign as far as the adoption of the technology decisions required buy, install IT systems, and offering training courses for their employees.

5.8.2.3 Age of the manager

The manger age is sown in Figures (5-20) below. It can be seen from the figure that the majority of the manager are >40 years old (38.5%), followed by(36-40years) 25.4% , (31-35years) 23.1% and only 13.1% are between 21-35years. This means that the young people have little influence in the managerial matters.

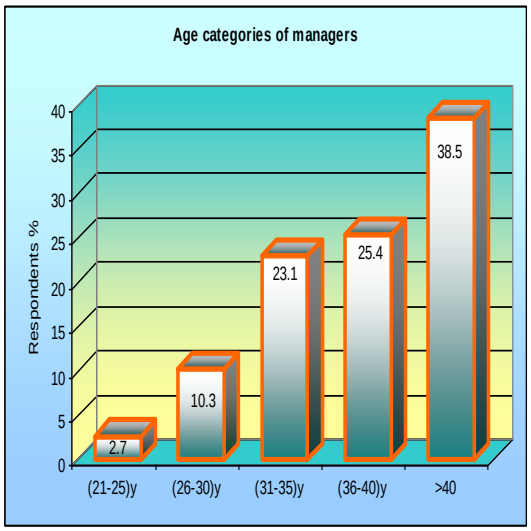


Figure (5-20): Age of the managers

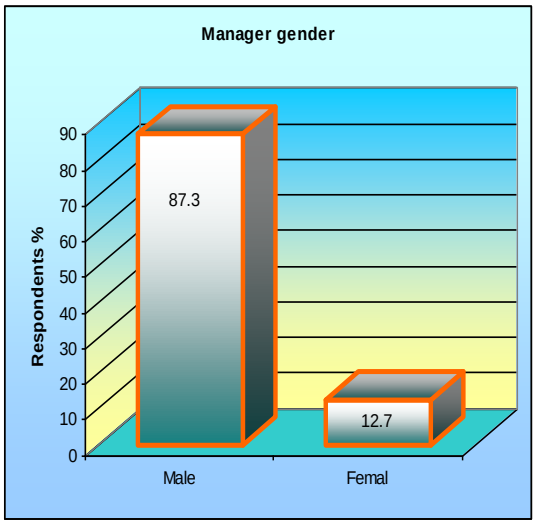


Figure (5-21): Gender

5.8.2.4 Gender

The gender of the surveyed managers is shown in Figure (5-21) above. It can be seen from the above mentioned figure is that 87.3% of the managers are male and only 12.7% female. This means that male dominant in decision making is profound in the developing countries culture.

5.8.2.5 Manager degree

It seems from Figure (5-22) below that the majority of the managers have master degree (39.6%). The second group is the BSc (25.4) followed by PhD (19.2%) and Diploma (15.8%). This is an interesting finding because most of the managers are highly qualified.

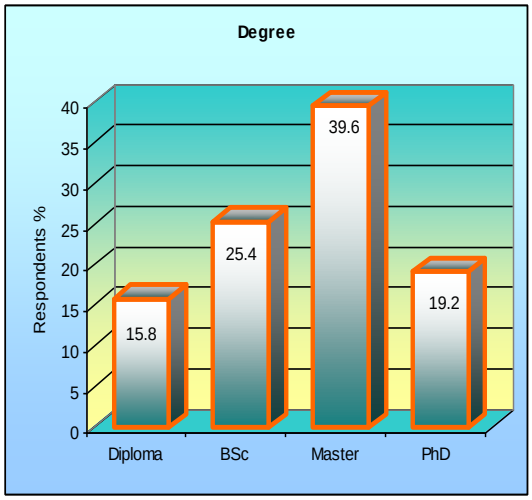


Figure (5-22): Degree

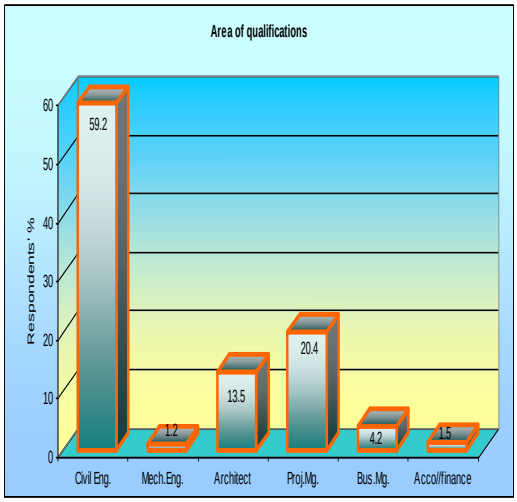


Figure (5-23): Area of qualifications

5.8.2.6 Manager area of qualifications

The areas of qualifications of the managers are shown Figure (5-23) above. It is clear from the mentioned figure that the majority (59.2%) of the managers have civil engineering background followed by the project management area (20.4%). This is related to fact that this research is related to the Libyan construction organisations only and this result is expected.

5.8.2.7 Country of graduation

Figure (5-24) shows the country of graduations. It is clear from the figure is that most managers graduated from Libyan universities (56.5%) flowed by (17.3%) from European countries such as UK and France and Russia. 14.2% from Arab countries such as Egypt, Iraq and Jordan. 7.7% graduated from US and Canada and 4.2% graduated from far east such as Indonesia, Malaysia and China.

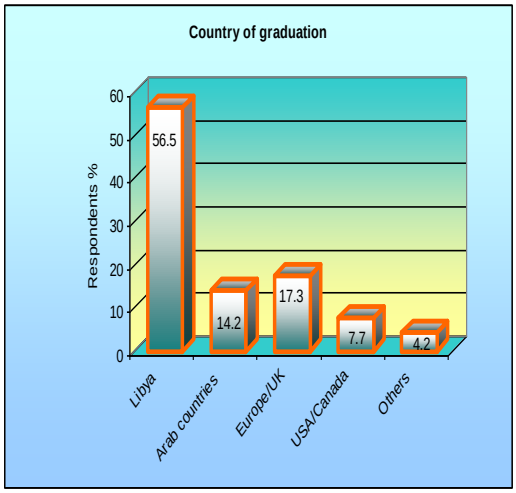


Figure (5-24): Country of graduation

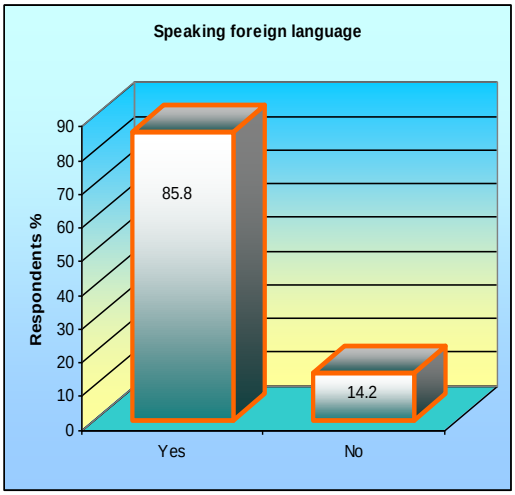


Figure (5-25): Speaking foreign language

5.8.2.8 Ability of the manager of speaking foreign language

This question is related to the ability of the managers of speaking foreign language. It seems from Figure (5-25) that 85.7%) are able to speak foreign language. This is a good sign which help the communications with international organisations and also enables the managers to understand the functionality of both the software and the hardware manuals which are usually written in foreign languages.

5.8.3 Descriptive analysis of the IT moderator factors

The descriptive analysis here includes the analysis to the variables of each of the IT moderator factors. It can be seen from Table (5-3) below that each factor has number of variables. The voluntariness, has 4 variables, external orientation, has 7 variables, achievement orientation has 2 variables, company slack has 3 variables, pro-activity has 3 variables, environmental dynamism has 5 variables and business-level attitude toward IT adoption has 4 variables. The analysis of these factors was carried out one by one as follows.

Table (5-3): IT adoption moderator factors and their variables.

No	Moderating variables	Number of questions
1	Voluntariness	4
2	External orientation	7
3	Achievement orientation	2
4	Company slack	3
5	Pro-activity	3
6	Environmental dynamism	5
7	Business-level attitude toward IT adoption	4
	Total	29 questions

Voluntariness

This factor consists of four questions as shown in Figure (5-26, H1 to H4). The responses to question H1 show that the majority of the managers believe that their clients do not expect them to use the IT. This could be related to fact that most people there are not familiar with the IT systems. The sanction against Libyan has a negative impact on the adoption of the technology within Libyan society. The responses to question H2 show that the majority of the managers believe that the use of the IT is voluntary and not compulsory.

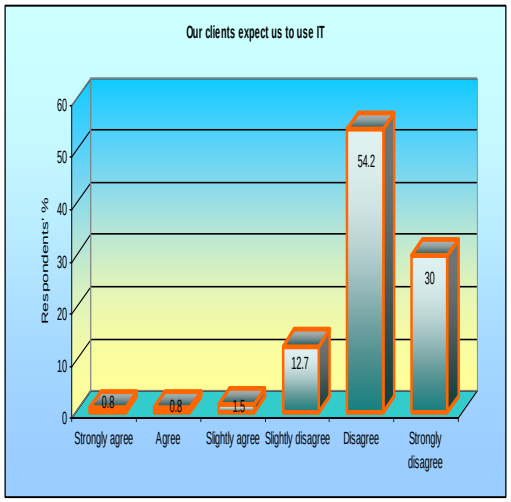


Figure (5-26): Voluntariness- H1

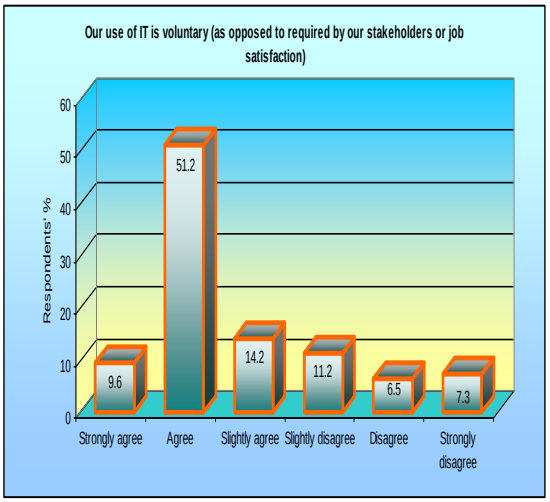


Figure (5-26): Voluntariness- H2

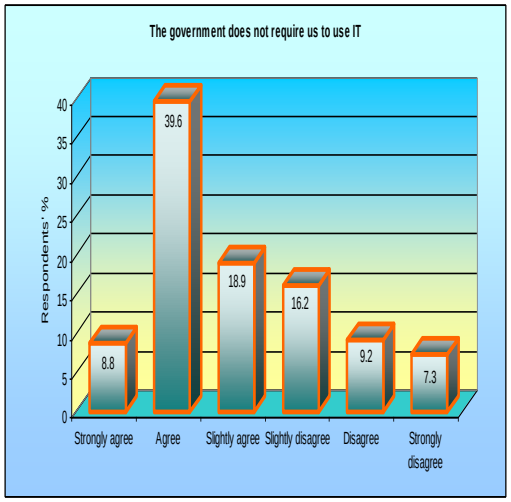


Figure (5-26): Voluntariness- H3

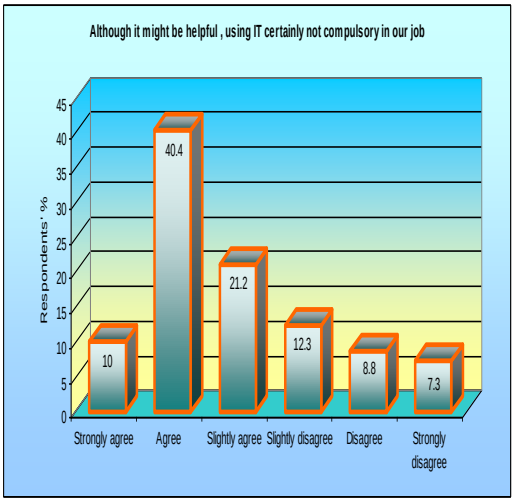


Figure (5-26): Voluntariness- H4

This point also mentioned by many managers during the interviews which were carried out with 26 managers. The voluntariness use of the technology could have negative impact on the organisations due to the fact that employees do not consider the use as part of their job satisfactory requirements. Technology is very important in this time and every employee should have a level of knowledge to cope with new challenges and requirements.

The government also does not support the compulsory use of the IT (Figure 5-26-H3) and the researcher believes this issue should be reconsidered to promote the IT use in the Libyan organisations.

While in question H_4 the majority of the managers indicated that the use of IT in their organisation is not compulsory. It can be concluded from the above responses that the use of IT in Libyan construction organisations is voluntary and the government and the management have little impact to enforce the use of IT systems.

External orientation

This factor consists of 7 questions related to the external orientation of the organisations. The responses to these questions are shown in figure (5-27, I1 to I7). It is clear from the responses of the managers that they are well externally oriented. This indicates that their businesses are derived by clients satisfaction, commitments, understanding clients needs, creating greater values for clients, measuring clients satisfactions, attention to after sales

services and understanding how everyone in the organisation contribute positively toward their clients. This type of attitude is needed to survive in the long term of their business strategies.

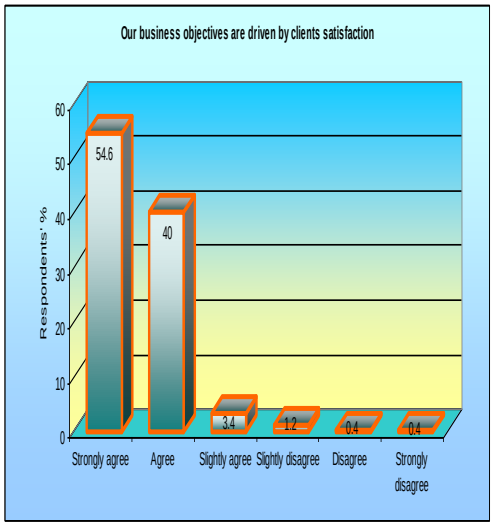


Figure (5-27): External orientation I1

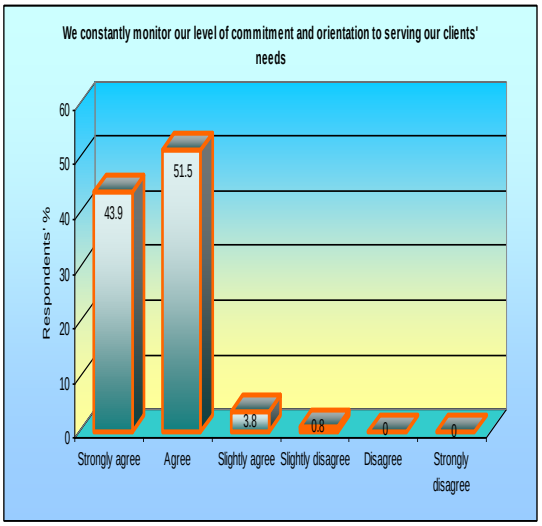


Figure (5-27): External orientation I2

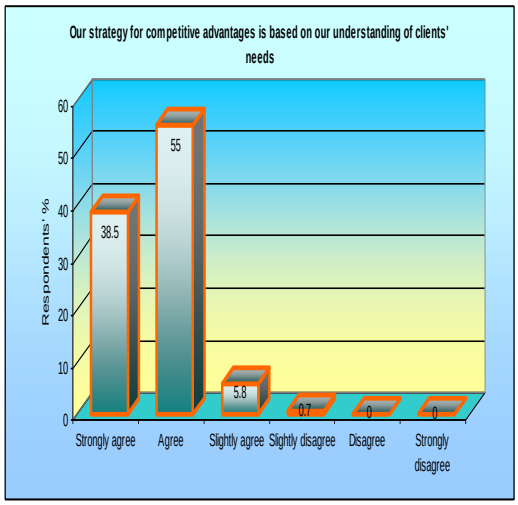


Figure (5-27): External orientation I3

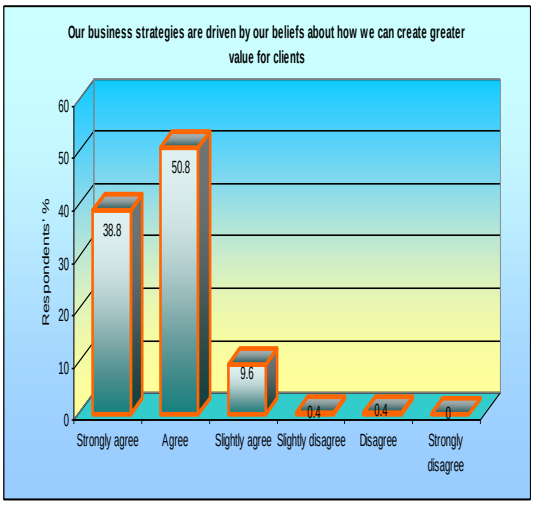


Figure (5-27): External orientation –I4

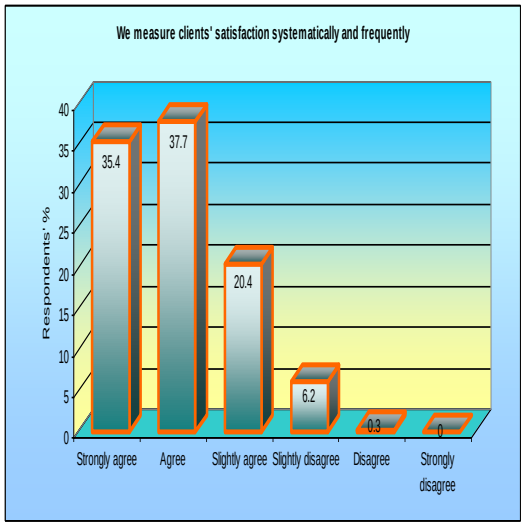


Figure (5-27): External orientation I5

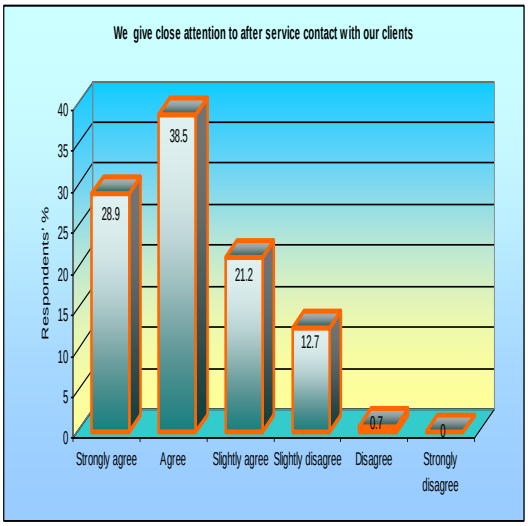


Figure (5-27): External orientation –I6

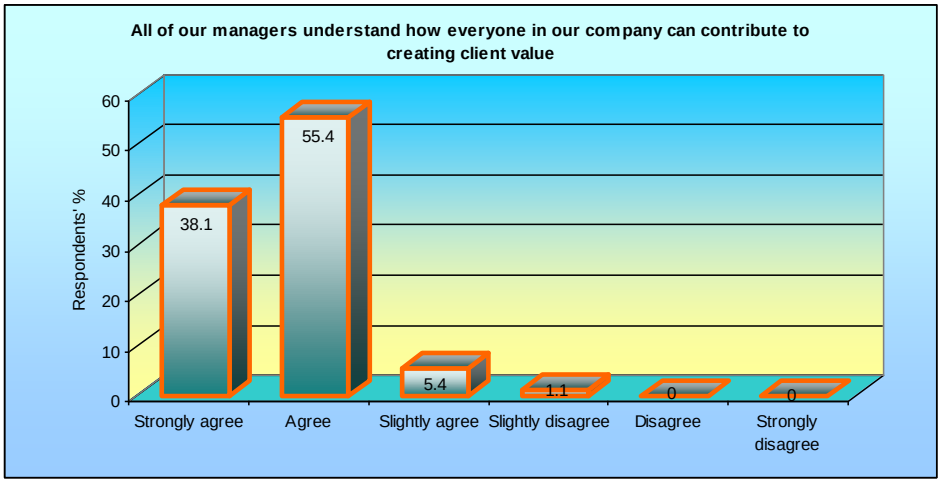


Figure (5-27): External orientation –I7

Achievement orientation

This factor consists of two questions as shown in Figure (5-28, J1 to J2) below. These questions are related to the achievement of goals and being a leader in the field is very important. It is clear from the responses to both questions that the majority of the surveyed managers believe that they are well oriented themselves to achieve their goals and to be leaders in their field. This is a good sign which could help in developing their business activities further and further.

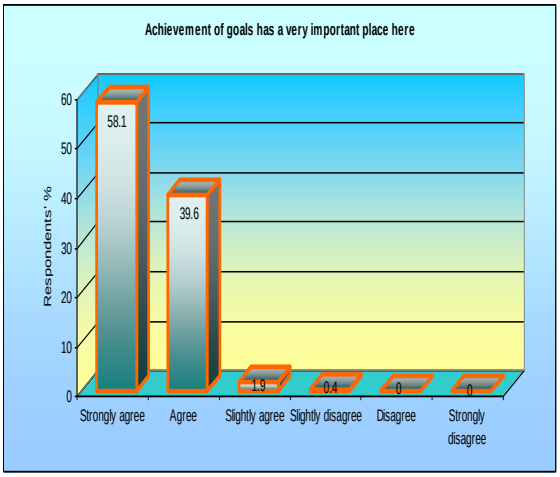


Figure (5-28):Achievement orientation J1

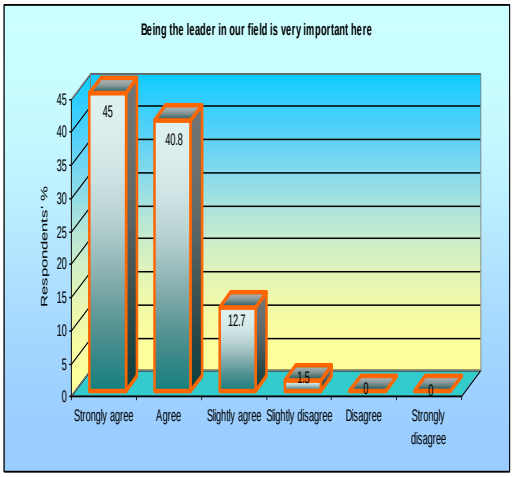


Figure (5-28): Achievement orientation-J2

Company slack

This factor comprises of 3 questions as shown in Figures (5-29, K1 to K3) below. These questions are related to the company slack such financial resources, labour skills and no shortage of managerial talent to run the organisations effectively. It is clear from the responses that the majority of the managers believe that they have enough resources for capital projects and have no shortage in labour skills and also no shortage of talented managers to run their organisations. This findings also supported by the interviews carried out by the researcher with 26 managers. However, the managers indicated in the interviews that there is shortage in skilled workforce and suggested training courses for managers should be increased in the IT field.

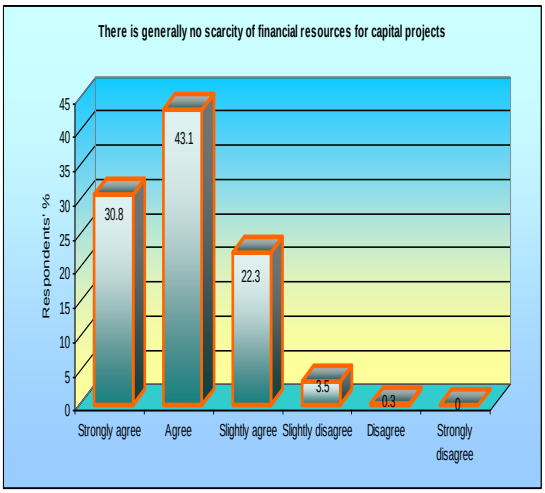


Figure (5-29): Company Slack-K1

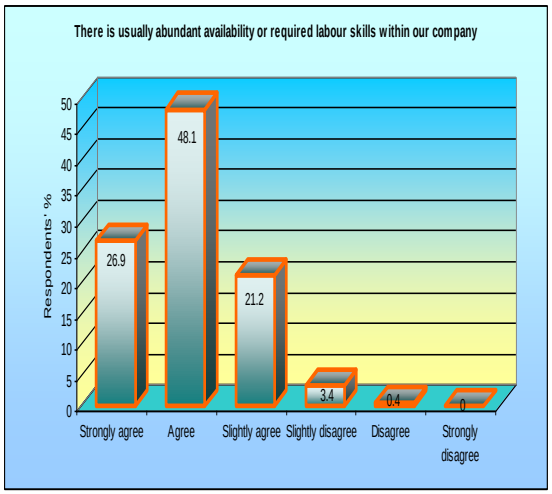


Figure (5-29): Company Slack-K2

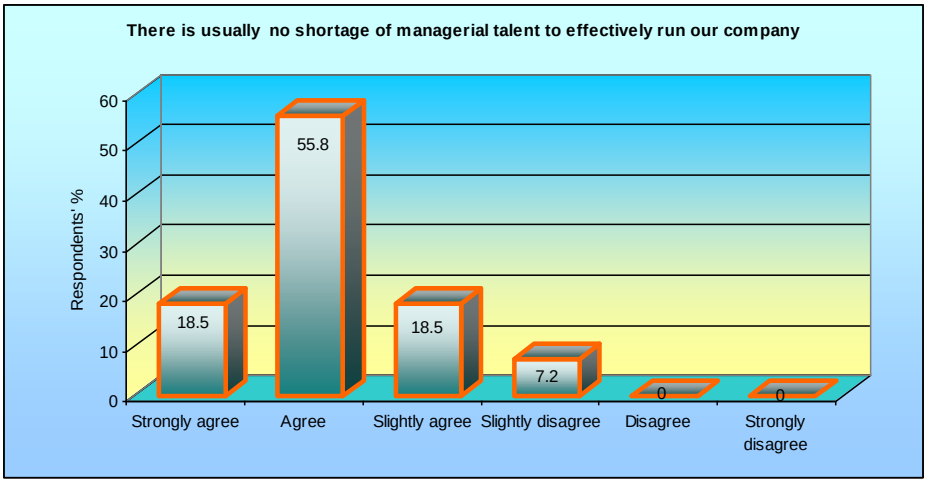


Figure (5-29): Company Slack-K3

Pro-activity

This factor comprises of three questions as shown in Figure (5-30, L1 to L3). These questions are related to the how the organisations respond to actions that competitors initiate (L1), the organisation is very seldom the first business to introduce new products or technology (L2) and our organisations seek to avoid clashes, preferring 'live and let others live'. The responses to the first question show that most managers responded positively to the competitors actions. The responses to question (L2) show that nearly three quarter of the surveyed organisations agrees that their organisations are very seldom are the first business to introduce new technology or products. The results of question (L3) are also similar to that of question (L2). This means that the surveyed organisations do not have the initiatives in introducing new products/technology and also avoid clashes with their competitors.

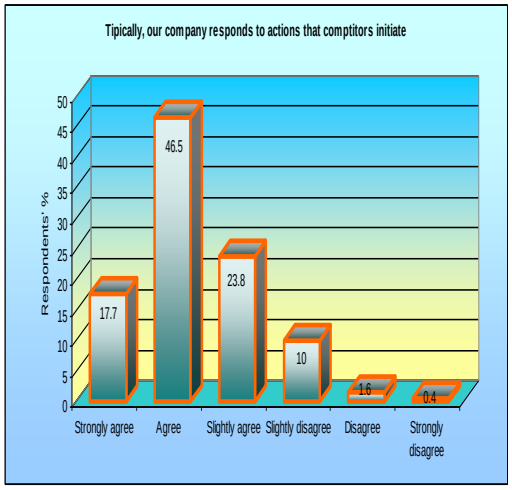


Figure (5-30): Pro-activity-L1

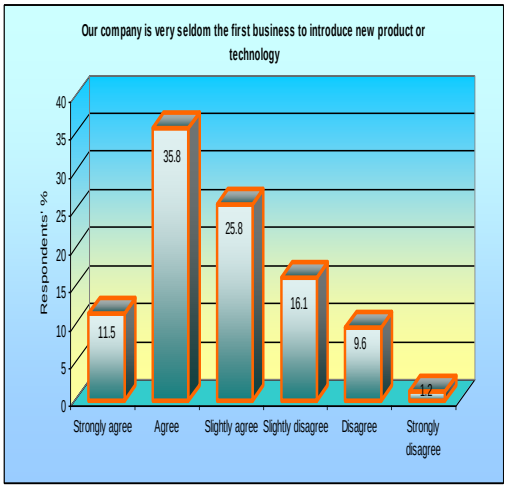


Figure (5-30): Pro-activity-L2

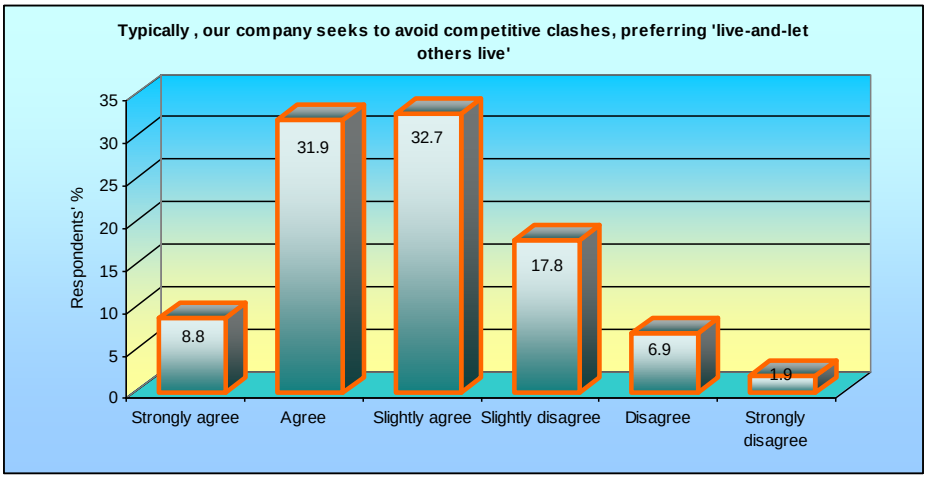


Figure (5-30): Pro-activity-L3

Environmental dynamism

This factor consists of 5 questions as shown in Figure (5-31, M1 to M5). These questions are related to the environmental dynamism of the organisation such as: changing marketing practices, rate of products/services which becoming obsolete in the industry is very slow, predicting of competitor's actions, forecasting demands and taste of consumers and the technology changes. It seems from the results shown in the above mentioned figures that the majority of managers' responses are positive. This means that they are able to change their practices to fit the surrounding environment and its dynamism.

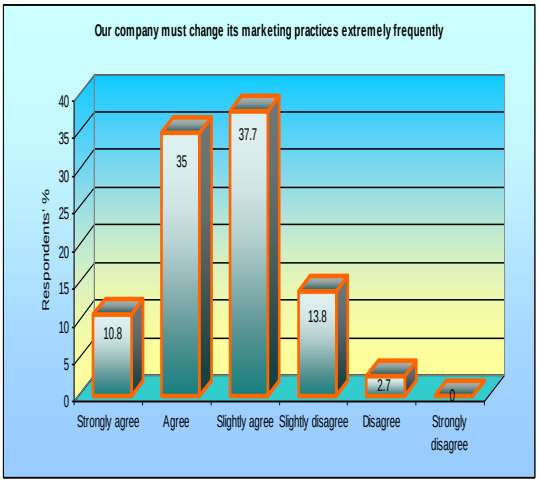


Figure (5-31): Environmental orient-M1

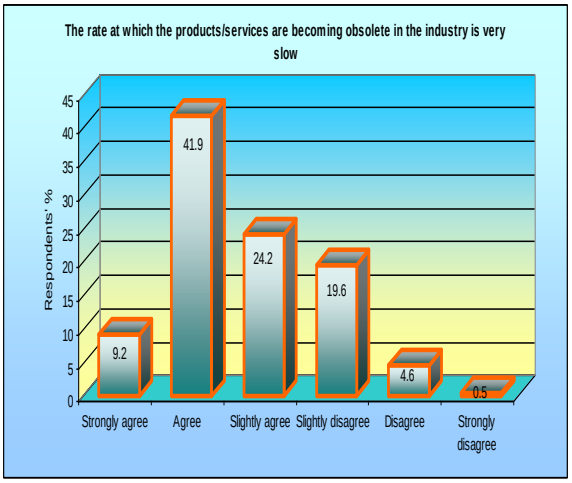


Figure (5-31): Environmental orient-M2

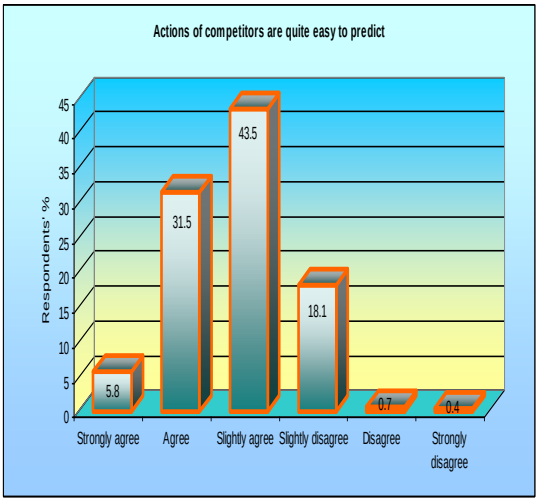


Figure (5-31): Environmental orient-M3

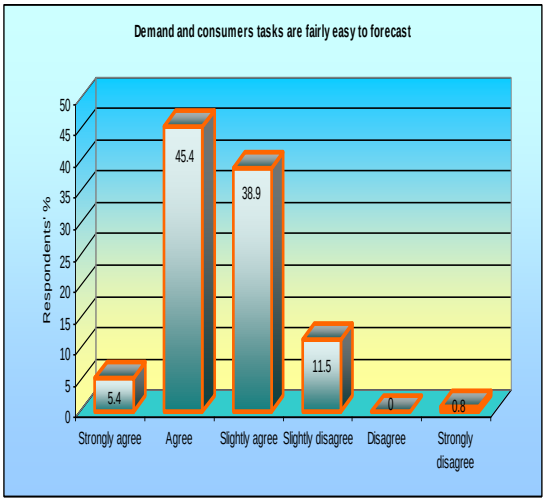


Figure (5-31): Environmental orient-M4

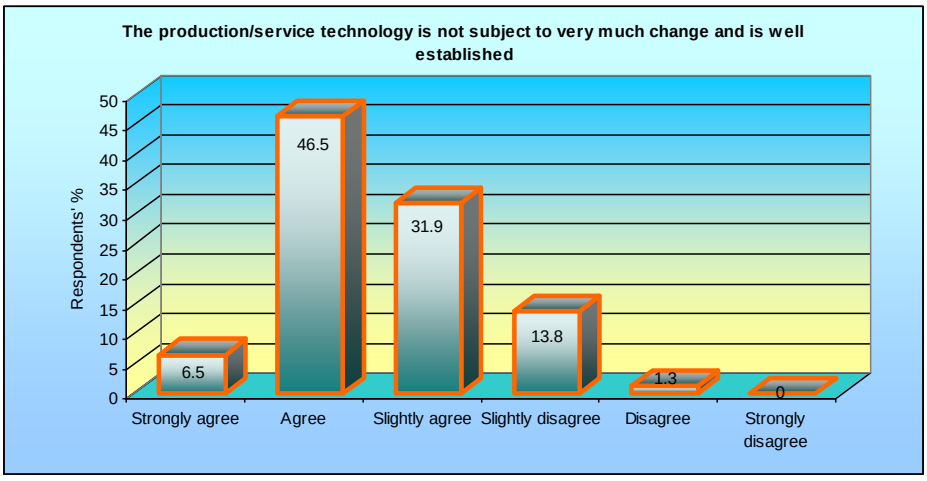


Figure (5-31): Environmental orientation-M5

Business-level attitude toward IT adoption

This factor comprises of 4 questions as shown in Figure (5-32, N1 to N4). As shown from the results plotted in the four figures that almost all the managers/Chief executives have positive attitudes toward the IT adoption. This is a very interesting finding.

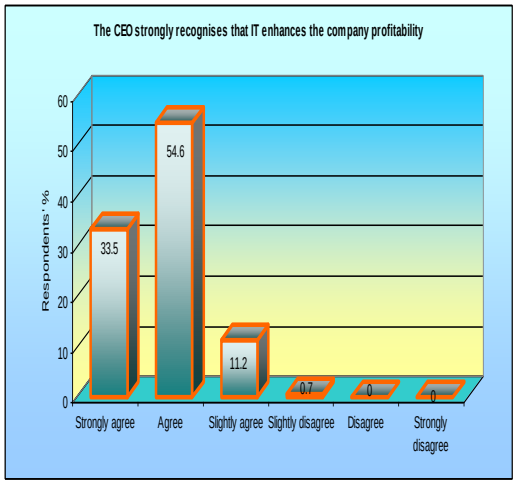


Figure (5-32) Business –attitude N1

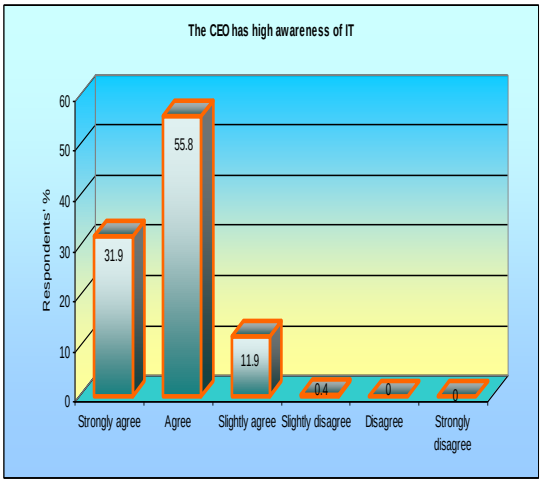


Figure (5-32) Business –attitude N2

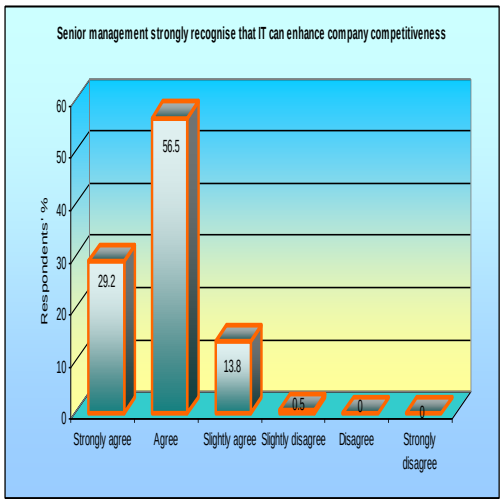


Figure (5-32) Business –attitude N3

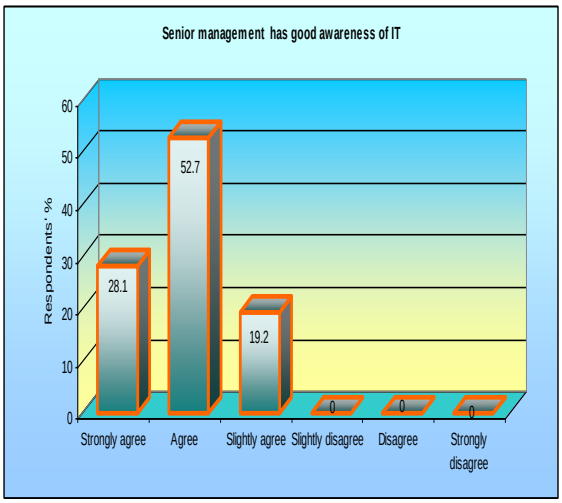


Figure (5-32) Business –attitude N4

5.9. Conclusions

The main conclusions from this chapter are as follows:

Conclusions from the interviews:

1. It has been found that most Libyan construction organisations are using the IT in their daily activities such as design, drawing, sending/receiving documents, e-mail for communications with their partners and with their main offices. However, the managers indicated that the equipment and the software should be modernised to match the change in the rapidly changing world.
2. There are internal obstacles facing the Libyan organisations such, lack of skilled workforce, security of the information on the internet, old management are conservative to the adoption of the IT systems. They also pointed out that lack of training courses in the field of IT.
3. The main external barriers are poor communication network especially in the desert areas. There are other difficulties such as poor banking, poor post office services which could affect the foreign investment in Libya and this will be sorted out by the government to let the managers and employees to be able to go through the internet and see the development in the field of technology adoption and utilisation.
4. The managers suggested that continuous development of their systems and also to put the suitable person in the right position in the managerial ranks. They also highlighted that the centralisation of the authority and decisions making have a negative impact on the adoption of the IT system. This also agreed with the literature in this field, Sultan and Chan (2000) and Wan et al (2005). They also highlighted the point that the government should support the private sector by using grants schemes to encourage the adoption of the IT systems.

5. The managers also highlighted that many old managers do not support the adoption and utilisation of the technology in their daily activities. This point is very important since the managers are the decision makers in their organisations and their role is vital in promoting the innovation via incentive schemes.
6. The managers also highlighted the motivations and incentive schemes to encourage the organisations and employees to use the technology.

7. The managers also highlighted the point that there are no government regulations to regulate the use of the internet and to protect the rights of both sellers and the buyers.

Conclusions from the questionnaire:

1. It has been found from the preliminary analysis of the questioonare that the managers in Libyan construction organisations are aware of the importance of the technology to business activities. This was reflected in their responses to the relative advantage of the technology, compatibity, image, ease of use, results demonstrability, visibility, trialability, facilitating conditions and subjective norms. In spite that there their opinion scattered between the six scale questioonare i.e. (1 strongly disagree, 2 disagree, 3 slightly disagree, 4 slightly agree, 5 agree, 6 strongly agree), the results showed that most of them believe that IT is important to their businees activities.

2. The preliminary results have shown that the characteristics of the surveyed managers as follows: most of the managers are Libyan, most of managers and engineers, most of the older managers, most of the male, their degrees mostly Master/PhD/Bsc, and most of qualified in civil engineering and most of them graduated from Libyan institutions and speaking foreign language.

3. The preliminarly results also shows that most of the surveyed organisations have IT budget, IT department, private organisations, most of them in business between 1-20 years, most of the contractor organisations, most of them have between 1-400 employees and their HQ are located in the west of the country.

4. The preliminarly results also shown that the surveyed organisations are aware of importance of the explorating variables such: voluntrainess, external orientation, achievement orientation, company slack, pro-activity, environment dynamism and business attitude toward the IT adoption. This means that the managers are aware of the needs and requirements of their businesses to be equipped with technology to survive the rapid change in the world.

Chapter Six: Advanced Statistical Analysis of the Quantitative Results and their Discussions

6.1 Introduction

This chapter deals with the data analysis of the dependent and independent variables specified in this study. It includes IT independent factors and their variables, reliability analysis of the independent variables, one way ANOVA analysis of the independent variables, factor analysis of the independent variables This chapter also included analysis of the dependent variable, reliability of the dependent variable, research hypothesis, testing the hypothesis, summary and results of the hypothesis, bivariate correlations among independent variables, multiple regression between IT adoption and the independent variables, stepwise regression and discussions and conclusions.

6.2 IT independent factors and their variables

The IT independent adoption factors considered in this research are 9 main factors which give 42 questions as shown in Table (6-1) below.

Table (6-1): IT adoption independent factors

No	Independent factors	Number of questions
1	Relative advantage	6
2	Compatibility	4
3	Image	4
4	Ease of use	6
5	Result demonstrability	4
6	Visibility	4
7	Trialability	4
8	Facilitating conditions	4
9	Subjective norms	6
	Total	42 questions

It is clear from Table (6-1) above that the total number of questions asked is 42 questions related to the nine factors in the table.

The conceptual model for this research is shown in Figure (6-1) below. The conceptual model shows the independent factors, moderator variables and the IT adoption which is the dependent variable. The analysis will be carried out first to the independent factors and the effect of the moderator variables will be explored later in this chapter.

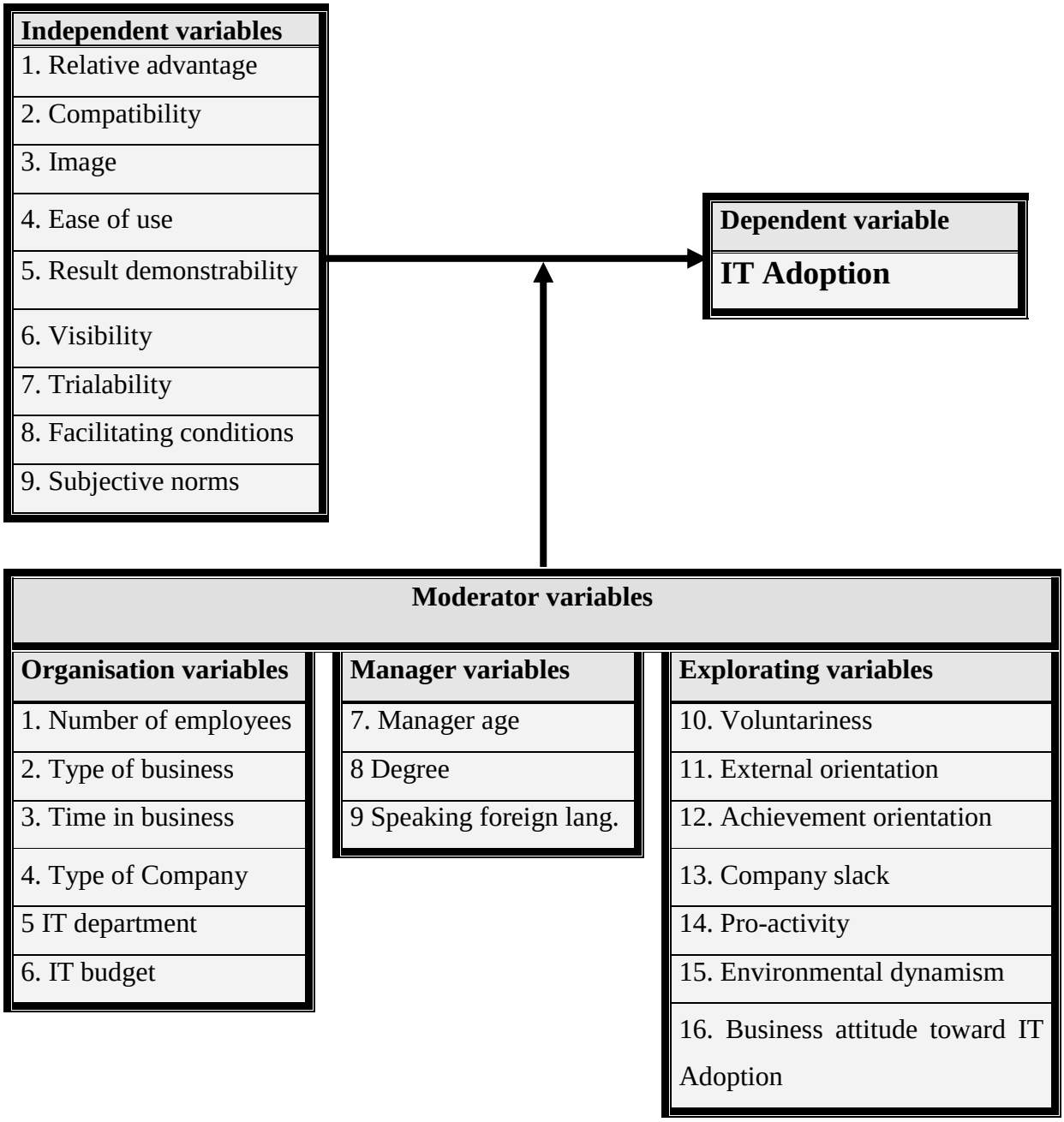


Figure (6-1): Conceptual model for this research

6.3 Analysis of the independent variables

It has been clarified earlier that this research has 9 independent adoption factors which give 42 variables as shown in Table (6-1) above. This section comprises of reliability tests analysis, one way ANOVA test analysis and Factor analysis of the independent variables.

6.3.1 Reliability analysis of the independent variables

The reliability analysis has been carried out for each construct of the nine factors of the independent variables and also for the whole factors using SPSS version 15. The results are shown in Table (6-2) below. It is clear from these figures that all the 9 constructs have high values of reliability which means that the designed tool is reliable and can be used with confidence. Nunnally (1967, 226) suggested that reliabilities between 0.50 to and 0.60 is sufficient for basic research. It can be seen from Table (6-2) below that the reliabilities values of the independent variables of this research ranging between 0.674 and 0.869, which are acceptable Pallant (2010). These figures indicate that the design constructs are reliable. The reliability figure for the whole constructs is 0.917 which also indicates that the designed tool is confirming the reliability of the constructs.

Table (6-2): Reliability tests for the independent variables.

No	Construct	No of questions	Cronbach's Alpha
1	Relative advantage	6	0.859
2	Compatibility	4	0.844
3	Image	4	0.674
4	Ease of use	6	0.780
5	Result demonstrability	4	0.757
6	Visibility	4	0.667
7	Trialability	4	0.869
8	Facilitating conditions	4	0.823
9	Subjective norm	6	0.776
	Total	42 questions	0.917

6.3.2 One Way ANOVA analysis of the independent variables

One way ANOVA analysis has been carried out to compare the mean answers for each question of the independent factors. The independent factors and their variables are shown in Table (6-3) below. Table (6-3) shows that there are nine factors which include relative advantage (6 variables), compatiblility (4 variables), image (4 variables), ease of use (6 variables), result demonstrability (4 variables), visibility (4 variables), trialability 4 variables), facilitating conditions (4 variables) and subjective norms (6 variables). Each question was designed on six Likert scale as follows: 1=

strongly disagree, 2= disagree, 3=slightly disagree, 4= slightly agree, 5= agree and 6= strongly agree.

The ANOVA test results indicate that almost all the questions have shown there are significant differences between the means of each question at ($p < 0.05$) except questions D2 (ease of use) and P1 (subjective norm) which have shown no significant differences between their means.

Table (6-3): ANOVA of the independent variables

	A: Relative Advantage	Sig
A-1	Using IT improves the quality of the work we do	0.000
A-2	Using IT improves our job performance	0.004
A-3	Using IT increases our effectiveness	0.001
A-4	Using IT gives us greater control over our work	0.001
A-5	Using IT increases our productivity	0.000
A-6	Overall, we find using IT advantageous in our job	0.023
B	**Compatibility**	
B-1	Using IT is compatible with all aspects of our wok	0.000
B-2	Using IT is compatible with our current situation	0.000
B-3	We think that using IT fits well with the way we like to work	0.000
B-4	Using IT fits into our works style	0.000
C	**Image**	
C-1	Using IT improves our image within the company	0.003
C-2	People in our company who use IT have more prestige than those who do not	0.000
C-3	People in our company who use IT have a high profile	0.000
C-4	Having IT is status symbol in our company	0.000
D	**Ease of Use**	
D-1	We believe that IT is cumbersome to use	0.000
D-2	Using IT requires a lot of effort	0.763
D-3	Using IT is often frustrating	0.000
D-4	We believe that it is easier to get IT to do what we want to do	0.084
D-5	Learning to operate IT is easy for us	0.000
D-6	Overall, we believe that IT is easy to use	0.000
E	**Result Demonstrability**	
E-1	We would have no difficulty telling others about results of using IT	0.000
E-2	We believe we could communicate to others the consequences of using IT	0.000
E-3	The results of using an IT are apparent to us	0.000
E-4	We would have difficulty explaining why using IT may not be beneficial	0.000
F	**Visibility**	
F-1	We have seen what others do using their IT	0.000
F-2	In our company, one sees IT in many places	0.000
F-3	IT is not very visible in our company	0.000
F-4	It is easy for us to observe others using IT in our company	0.000
G	**Trialability**	
G-1	We usually have good opportunity to try various IT applications	0.000
G-2	We know where we can go to satisfactorily try out various uses of IT	0.000
G-3	Before deciding whether to use any IT applications, we are able to properly	0.000

	try them out	
G-4	We are permitted to use IT on a trial basis long enough to see what it could do	0.000
N	**Facilitating Conditions**	
N-1	We have the resource necessary to use IT	0.004
N-2	We have knowledge necessary to use IT	0.001
N-3	The company staff, in the main office, are available for assistance with IT difficulties.	0.000
N-4	We have knowledge sources (e.g. books, documents, consultants) help us learn about IT system	0.000
P	**Subjective Norm**	
P-1	The majority of leading companies within the supply chain use IT	0.469
P-2	The majority of trading parties within the supply chain use IT	0.003
P-3	The majority of peer competitors use IT	0.000
P-4	The government actively promotes IT	0.000
P-5	IT adoption is supported by government grants	0.000
P-6	Our employees encourage us to use the IT	0.000

The significance in means differences indicates that the managers' responses to the questions are different. This is related to fact that those managers have different backgrounds (such engineering, finance, computer science –etc). Therefore the differences are expected.

In order to explore further the ANOVA analysis two examples outputs have been selected. The first example which shows significant difference between the means of the answers 'A1- relative advantage' and the second example which shows no significant difference between the means 'D2-ease of use'.

The ANOVA outputs for the first example are shown in Table (6-4), Table (6-5) and Table (6-6) below. Table (6-4) below shows the means of the adoption for different managers' responses 'slightly agree', 'agree' and 'strongly agree'.

Table (6-4): ANOVA description output of 'A1-Relative advantage'

Descriptive

Adoption

	N	M ean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Slightly agree	23	22.8261	5.13147	1.06999	20.6071	25.0451	12.00	35.00
Agree	131	24.7710	6.90548	.60333	23.5774	25.9646	7.00	37.00
Strongly agree	106	27.8302	6.60227	.64127	26.5587	29.1017	8.00	41.00
Total	260	25.8462	6.84462	.42449	25.0103	26.6820	7.00	41.00

Table (6-5) shows the output of the ANOVA statistical test. The result indicates that the differences between groups and within groups is significant (p =0.000)

Table (6-5): ANOVA analysis output –between and within groups 'A1-relative advantage'

ANOVA

Adoption

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	778.469	2	389.234	8.809	.000
Within Groups	11355.378	257	44.184		
Total	12133.846	259			

Table (6-6) explore the differences between means in more details. The multiple comparisons of means show that there is a significant difference between strongly agree and slightly agree (p = 0.003) and also there is a significant difference between strongly agree and agree (p = 0.001). The important point here is that all the compared groups agreed that using the IT improves the quality of their works in different degrees.

Table (6-6): ANOVA test multiple compressions between means 'A1-relative advantage'

Multiple Comparisons

Adoption

Tukey HSD

(I) Using IT Improves the quality of the work we do	(J) Using IT Improves the quality of the work we do	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Slightly agree	Agree	-1.94491	1.50278	.400	-5.4875	1.5977
	Strongly agree	-5.00410*	1.52902	.003	-8.6086	-1.3996
Agree	Slightly agree	1.94491	1.50278	.400	-1.5977	5.4875
	Strongly agree	-3.05920*	.86840	.001	-5.1063	-1.0121
Strongly agree	Slightly agree	5.00410*	1.52902	.003	1.3996	8.6086
	Agree	3.05920*	.86840	.001	1.0121	5.1063

*. The mean difference is significant at the 0.05 level.

Table (6-7) to (6-9) related to second example which shows no significant differences between the means of the respondents. Table (6-7) shows that the means are almost

equal. Table (6-8) shows that the differences between groups and within groups is not significant (*p*= 0.763 which is more that 0.05), there the differences are not significant. Table (6-9) explores the difference between means and the results shown no one had significant difference. This means that the managers' responses to the question '*Using IT requires a lot of effort'* have approximately equal judgement.

Table (6-7): ANOVA description output of 'D2-Ease of Use'

Descriptives

Adoption

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Strongly disagree	6	26.5000	3.08221	1.25831	23.2654	29.7346	22.00	30.00
Disagree	55	26.4364	7.17187	.96705	24.4975	28.3752	8.00	37.00
Slightly disagree	84	25.1310	7.58372	.82745	23.4852	26.7767	8.00	41.00
Slightly agree	43	26.4651	6.67386	1.01775	24.4112	28.5190	14.00	40.00
Agree	47	25.2553	6.53242	.95285	23.3373	27.1733	7.00	36.00
Strongly agree	25	26.8400	4.91325	.98265	24.8119	28.8681	19.00	39.00
Total	260	25.8462	6.84462	.42449	25.0103	26.6820	7.00	41.00

Table (6-8): ANOVA analysis output –between and within groups 'D2-Ease of Use'

ANOVA

Adoption

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	122.266	5	24.453	.517	.763
Within Groups	12011.581	254	47.290		
Total	12133.846	259			

Table (6-9): ANOVA test multiple compressions between means 'D2-Ease of Use'

Multiple Comparisons

Adoption

Tukey HSD

(I) Using IT requires a lot of effort	(J) Using IT requires a lot of effort	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Strongly disagree	Disagree	.06364	2.95659	1.000	-8.4265	8.5538
	Slightly disagree	1.36905	2.90596	.997	-6.9757	9.7138
	Slightly agree	.03488	2.99689	1.000	-8.5710	8.6408
	Agree	1.24468	2.98124	.998	-7.3163	9.8056
	Strongly agree	-.34000	3.12621	1.000	-9.3173	8.6373
Disagree	Strongly disagree	-.06364	2.95659	1.000	-8.5538	8.4265
	Slightly disagree	1.30541	1.19281	.883	-2.1199	4.7307
	Slightly agree	-.02875	1.39985	1.000	-4.0486	3.9911
	Agree	1.18104	1.36601	.955	-2.7416	5.1037
	Strongly agree	-.40364	1.65873	1.000	-5.1669	4.3596
Slightly disagree	Strongly disagree	-1.36905	2.90596	.997	-9.7138	6.9757
	Disagree	-1.30541	1.19281	.883	-4.7307	2.1199
	Slightly agree	-1.33416	1.28947	.906	-5.0370	2.3687
	Agree	-.12437	1.25265	1.000	-3.7215	3.4728
	Strongly agree	-1.70905	1.56670	.885	-6.2080	2.7899
Slightly agree	Strongly disagree	-.03488	2.99689	1.000	-8.6408	8.5710
	Disagree	.02875	1.39985	1.000	-3.9911	4.0486
	Slightly disagree	1.33416	1.28947	.906	-2.3687	5.0370
	Agree	1.20980	1.45118	.961	-2.9574	5.3770
	Strongly agree	-.37488	1.72955	1.000	-5.3415	4.5917
Agree	Strongly disagree	-1.24468	2.98124	.998	-9.8056	7.3163
	Disagree	-1.18104	1.36601	.955	-5.1037	2.7416
	Slightly disagree	.12437	1.25265	1.000	-3.4728	3.7215
	Slightly agree	-1.20980	1.45118	.961	-5.3770	2.9574
	Strongly agree	-1.58468	1.70228	.938	-6.4730	3.3036
Strongly agree	Strongly disagree	.34000	3.12621	1.000	-8.6373	9.3173

	Disagree	.40364	1.65873	1.000	-4.3596	5.1669
	Slightly disagree	1.70905	1.56670	.885	-2.7899	6.2080
	Slightly agree	.37488	1.72955	1.000	-4.5917	5.3415
	Agree	1.58468	1.70228	.938	-3.3036	6.4730

6.3.3 Factor analysis of the independent variables

Woelfel (2002) defined the Factor analysis as 'a data reduction technique that tries to reduce a list of attributes or other measures to their essence, that is, a smaller set of 'factors' that capture the patterns seen in the data, The main benefits of factor analysis are that the analyst can focus their attention on the unique core elements instead of the redundant attributes, and as a data pre-processor for regression models'. This means factor analysis is a technique usually used to condense many variables into a few underlying constructs, Hedderson (1991,.p.172), While Foster (2001.p.231) indicated that factor analysis is a technique or family of techniques aims to simplify complex sets of data by analysing the correlation between them. Factor analysis has been carried out for this research constructs using principal component analysis method (PCA) as shown in Table (6-10) below.

Table (6-10): Factor analysis for the independent variables

Construct	Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy	Bartlett's Test of Sphericity (Sig.)	Principal Analysis (PCA) Component		Cronbach's Alpha
			Initial Eigen values (Cumulative %)	No of Components extracted	
RA	0.817	0.000	58.831	1	0.859
CO	0.781	0.000	68.336	1	0.844
IM	0.563	0.000	51.310	1	0.674
EU	0.726	0.000	66.525	2	0.780
RD	0.734	0.000	61.693	1	0.757
VI	0.687	0.000	52.257	1	0.667
TR	0.810	0.000	72.187	1	0.869
FA	0.722	0.000	65.742	1	0.823
SN	0.699	0.000	70.281	2	0.776

Where:

RA= Relative Advantage	CO= Compatibility	IM= Image
EU= Ease of Use	RD= Result Demonstrability	VI= Visibility
TR= Trialability	FC= Facilities Conditions	SN= Subjective Norms

It can be seen from Table (6-10) above that each construct has 1 principal component extracted except the construct ease of use (EU) and subjective norms (SN) each has 2 components.

The table also showed Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and also the Bartlett's test of sphericity and its significance. It is clear from the results that the (KMO) test indicates that the sample is adequate. The results obtained from factor analysis have the minimum value of KMO for factor analysis, Pallant (2010). The results also show that IM has the lowest (KMO) of 0.563, RA has the highest (KMO) of 0.817 and SN has the highest cumulative loading of 70.281.

The Bartlett's test of sphericity, which represents the statistical test for the overall significance of all correlations within a correlation matrix, Hair et al (2006) is also significant for all the constructs of this research.

6.4. Analysis of the dependent variable

The preliminary analysis and the derivation of the dependent variable have been discussed in Chapter 5, section 5.7. This section deals with the reliability of the questions used in deriving the dependent variable as explained below.

6.4.1 The reliability of the dependent variable

The reliability statistical test of the dependent variable questions was carried out by using the SPSS software and the results are shown in Table (6-11) below. It seems from this mentioned table that the reliability is high which indicates the constructs are valid to derive the dependent variable 'IT adoption'. The values of the Cronbach alpha are over 0.70 which are acceptable, Pallant (2010).

Table (6-11): Reliability of questions related to the dependent variable

No	Construct	No of variables	Cronbach's Alpha
1	Do you use one of the following software?	14	0.825
2	Please rate the skills in using the following software	14	0.779
	Total	28	0.868

6.5 Testing of Research Hypotheses

In this section the researcher will test the following hypothesis. These hypotheses are designed to test the relationship between the dependent variable 'IT adoption' and nine independent variables. These variables are explained above. Therefore, this research has nine hypotheses (because it has nine independent variables) as follows:

H_1: There is a positive relationship between the IT adoption and the relative advantage of the IT system

H_2: There is a positive relationship between the IT adoption and the compatibility of IT system

H_3: There is a positive relationship between the IT adoption and the image of the organisation resulted from the adoption

H_4: There is a positive relationship between the IT adoption and the Ease of use

H_5: These is adoptive relationship between the IT adoption and the Result Demonstrability

H_6: There is a positive relationship between IT adoption and the visibility

H_7: There is a positive relationship between IT adoption and Trialability

H_8: There is a positive relationship between IT adoption and Facilitating conditions

H_9: There is a positive relationship between the IT adoption and subjective norms.

In order to test the hypotheses of this research Pearson's correlation was carried out to examine whether there is any correlation between the dependent variable (IT adoption) and each of the independent variables as shown in Table (6-12) below. Table (6-12) shows the correlation between the dependent variable and independent variables and also the correlation among the independent variables.

Cohen (1988, p.79-81) and Pollant (2010, p.134) suggested the following values for the Pearson's correlation coefficient r as shown in Table (6-12) below:

Table (6-12): Strength of the correlation coefficients

0.10-0.29	0.30-0.49	0.50-1.0
Small/weak	Medium/moderate	Large/strong

Source: Cohen (1988, p.9-81) and Pollant (2010, p.134)

The correlation coefficient represents the strength of combination of two or more variables. The higher the value of the correlation coefficient means better correlation between the variables and vice versa.
The negative sign in front of the correlation coefficient means that high score on one variable associated low score on the other variable, Pollant (2010). The pairwise deletion helps to exclude any case with missing data of any variable considered in the analysis, Pollant (2010).

The correlation analysis enables the researcher to investigate the level of significance for the obtained values of r for the results. The significant values for r usually considered at 0.01 level (2 tailed) or 0.05 level (2-tailed) which means that small correlation between two variables not reach statistical significance at $p<0.01$ and $p<0.05$ respectively.

The correlation test also enables the researcher to examine the variables for any multicollinearity between the independent variables especially when carrying the multiple regression between dependent and several independent variables. Bryman and Cramer (2009) indicated if the correlation among the independent variables exceeds 0.8 problem of multicollinearity might occur and this affect the accuracy of the derived model. This will be discussed in more details in the multiple regression section in this chapter. It is clear from the obtained results that the maximum

correlation among the independent variables is between compatibility and trialability (0.518) sig. <0.01. This means that there is no multicollinearity problem among independent variables of this research.

The obtained results also show that the relationships between the dependent and all independent variables are positive and result demonstrability has the highest value of 0.402, sig at 0.01 and the lowest value of is 0.265 for the relative advantage.
The relationships between the dependent variable and each of the independent 9 variables are shown in Table (6-13) below. This will be explained one by one in this chapter.

Table (6-13): Pearson correlation coefficient among independent variables

		Relative advantage	Compatibility	Image	Ease of Use	Result Demonstrability	Visibility	Trialability	Facilitating conditions	Subjective Norms	IT adoption
Relative advantage	R Sig. N	1									
Compatibility	R Sig. N	0.490 0.000** 260	1								
Image	R Sig. N	0.449 0.000** 260	0.493 0.000** 260	1							
Ease of Use	R Sig. N	0.337 0.000** 260	0.376 0.000** 260	0.517 0.000** 260	1						
Result Demonstrability	R Sig. N	0.442 0.000** 260	0.339 0.000** 260	0.452 0.000** 260	0.316 0.000** 260	1					
Visibility	R Sig. N	0.354 0.000** 260	0.315 0.000** 260	0.418 0.000** 260	0.103 0.098 260	0.451 0.000** 260	1				
Trialability	R Sig. N	0.491 0.000** 260	0.518 0.000** 260	0.455 0.000** 260	0.278 0.000** 260	0.470 0.000** 260	0.379 0.000** 260	1			
Facilitating Conditions	R Sig. N	0.428 0.000** 260	0.460 0.000** 260	0.281 0.000** 260	0.253 0.000** 260	0.363 0.000** 260	0.375 0.000** 260	0.531 0.000** 260	1		
Subjective Norms	R Sig. N	0.273 0.000** 260	0.277 0.000** 260	0.261 0.000** 260	0.206 0.001** 260	0.320 0.000** 260	0.283 0.000** 260	0.329 0.000** 260	0.405 0.000** 260	1	
IT adoption	R Sig N	0.265 0.000** 260	0.351 0.000** 260	0.382 0.000** 260	0.294 0.000** 260	0.402 0.000** 260	0.347 0.000** 260	0.388 0.000** 260	0.362 0.000** 260	0.350 0.000** 260	1

**. Correlation is significant at the 0.01 level (2-tailed).

The relationship between IT adoption and relative advantage

The relationship between the dependent variable 'IT adoption' and the independent variable 'relative advantage' is shown in Table (6-14) below.

Table (6-14): Correlation between adoption and relative advantage

		Relative advantage-factor analysis score	Adoption
Relative advantage-factor analysis score	Pearson Correlation	1	.265**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.265**	1
	Sig. (2-tailed)	.000	
	N	260	260

**. Correlation is significant at the 0.01 level (2-tailed).

From this mentioned table it is clear that the correlation coefficient is 0.265, p=0.000 and N=260. For the purpose of the interpretation of the relationships between the two variables, this relationship is considered to be small/weak. The correlation coefficient indicates that the higher the relative advantage obtained from the use of the IT the more IT adoption associated with this use.

Figure (6-2) and Figure (6-3) below show that the dependent variable (IT adoption) follows the path of normal distribution with zero mean. This test supports the statistical tests of significance shown above.

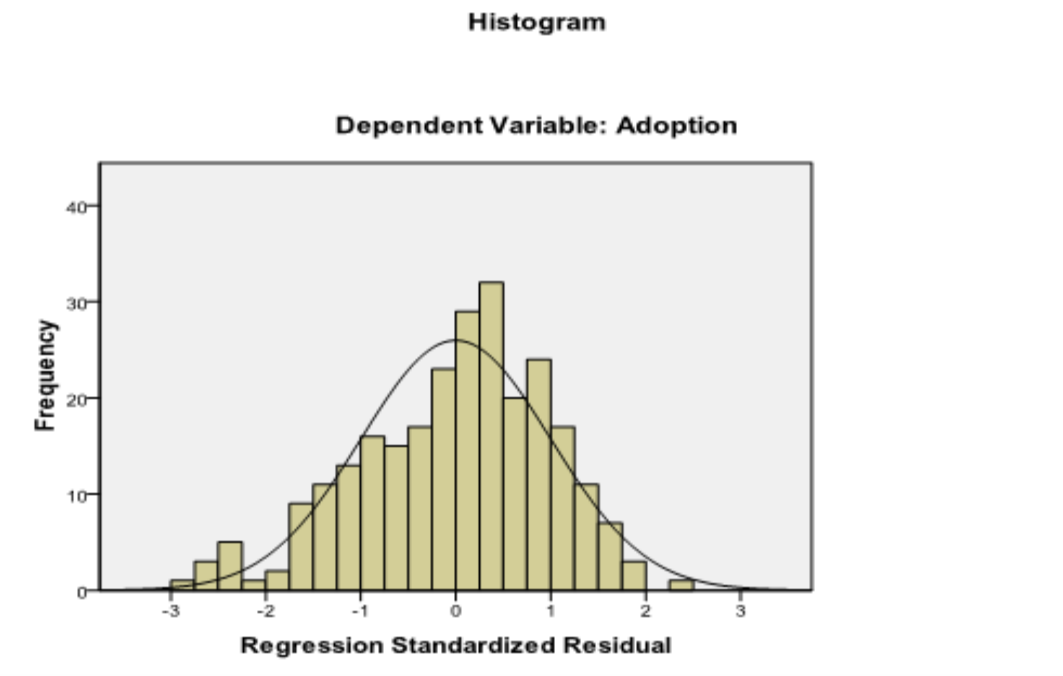


Figure (6-2): Normal distribution of the IT adoption

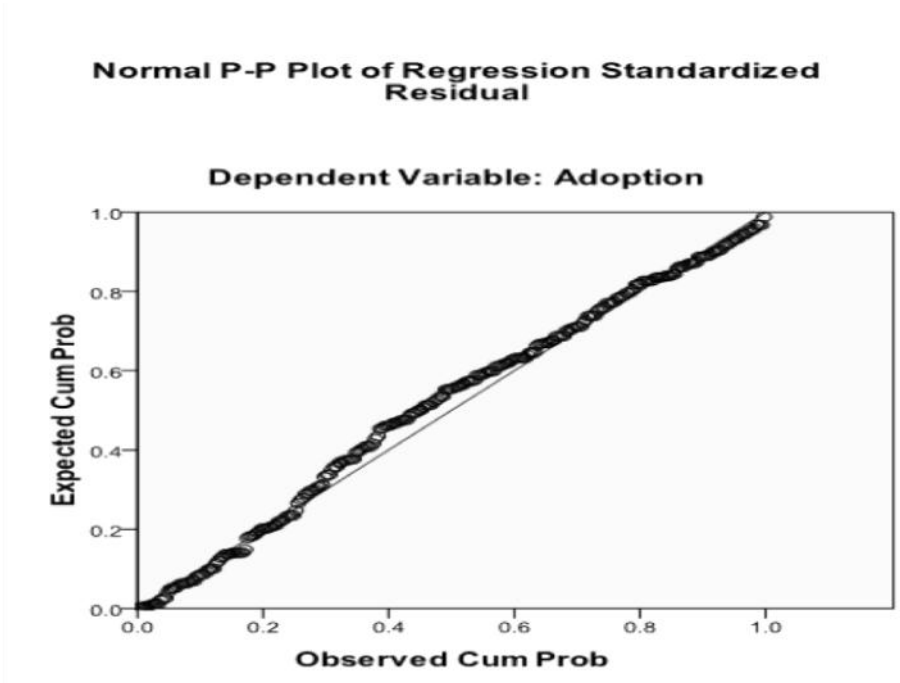


Figure (6-3): Probability plot of IT adoption

The relationship between the adoption and relative advantage is shown in Figure (6-4) below

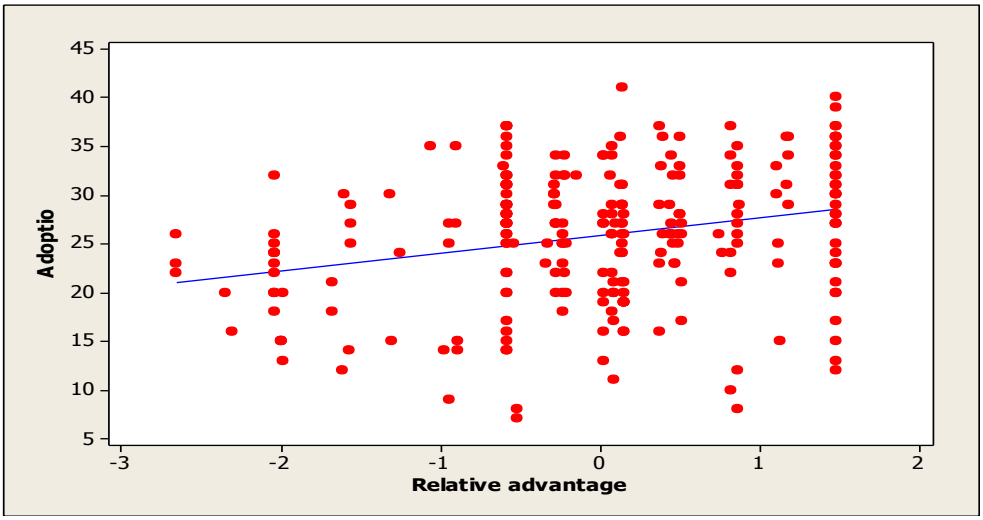


Figure (6-4): The relationship between the adoption and relative advantage

It is clear from Figure (6-4) that there is a positive relationship between the adoption and the relative advantage. Therefore, the alternative hypothesis (i.e. there is a positive relationship between the two variables will be accepted. This means that H_1 is accepted. This agreed with the literature e.g. Lee (2004), Nan et al (2008), Tan et al (2011) and Park (2009). This will discuss in detail in the discussion section.

The relationship between IT adoption and Compatibility

The correlation coefficient between adoption and compatibility is shown in Table (6-15) below. It is clear from this mentioned table that the value of r=0.351, *p*= 0.000.

Table (6-15): Correlation between adoption and compatibility

		Compatibility- factor analysis score	Adoption
Compatibility- factor analysis score	Pearson Correlation	1	.351**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.351**	1
	Sig. (2-tailed)	.000	
	N	260	260

This means that in spite that the relationship between the adoption and compatibility classified as medium/moderate Cohen (1988) and Pallant (2010), it is confident that there is a positive relationship between the variables, r= 0.351, *p*=0.000.

The relationship between the adoption and the compatibility has been drawn as shown in Figure (6-5) below. This figure indicates that the relationship between adoption and compatibility is positive and this means that H_2 is accepted.

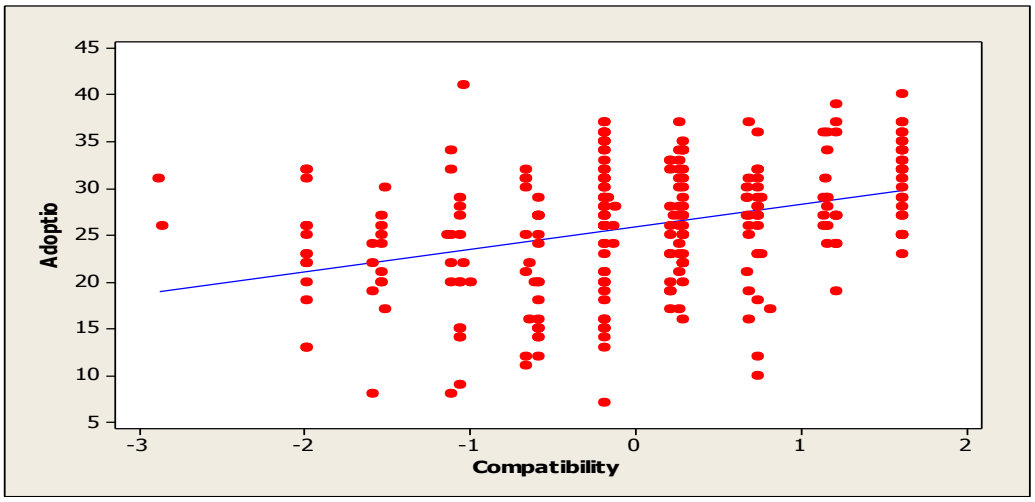


Figure (6-5): The relationship between IT adoption and compatibility

The relationship between the IT adoption and compatibility is positive which indicates that the more the understanding of the compatibility of the IT with business activities the more adoption to the technology. The finding of this study is supported by the literature e.g. Nan et al (2008), Lee (2004), Duan et al (2010) and Al-Gahtani (2003). This will be discussed further in the discussion section.

The relationship between IT adoption and Image

The correlation between adoption and image is shown in Table (6-16). It is clear from this mentioned table that the correlation between adoption and image is 0.382 and p=0.000. This means that there is a positive relationship between the two variables.

Table (6-16): Correlation between adoption and image

		Image- factor analysis score	Adoption
Image- factor analysis score	Pearson Correlation	1	.382**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.382**	1
	Sig. (2-tailed)	.000	
	N	260	260

The relationship has been drawn as shown in Figure (6-6) below. This relationship indicates that the more the managers think about the importance of the image of their

organisations the more the IT adoption occurs. Therefore the H_3 is accepted. The finding of this study is also supported by the literature e.g. Nan et al (2008), Alessia et al (2009), Chen et al (2011) and Kim and Lee (2010). This will be discussed in more detail under the discussion section.

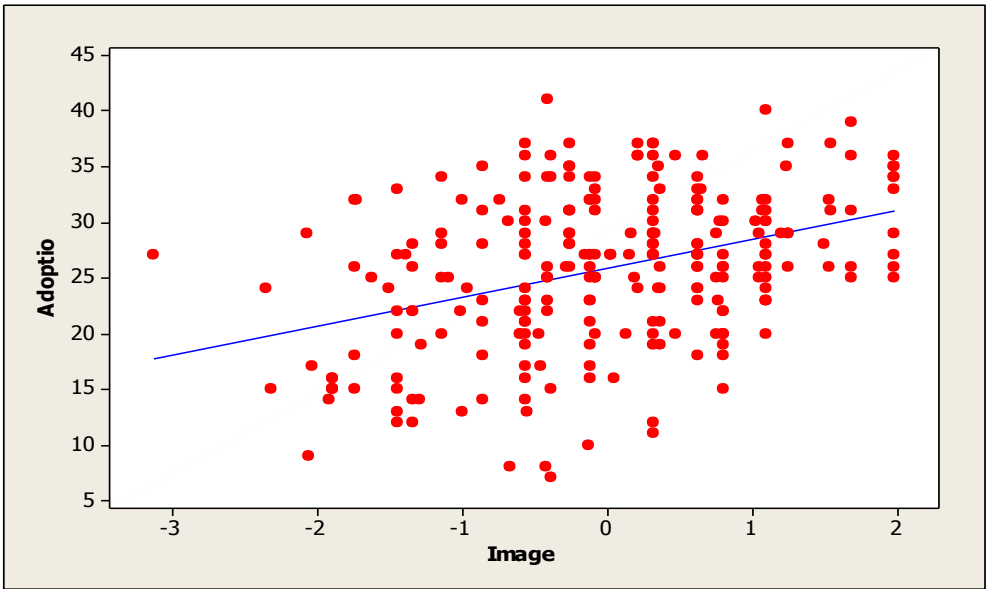


Figure (6-6): The relationship between adoption and image

The relationship between IT adoption and Ease of Use

The correlation coefficient between the adoption and ease of use is shown in Table (6-17) below. It is clear from this table that the correlation coefficient is equal to 0.294, *p=0.000*. The relationship between the IT adoption and the ease of use is shown in Figure (6-7).

It is clear from this mentioned figure that the relationship between the IT adoption and ease of use is positive which support the hypothesis H_4. This means that the perception of managers to ease of use of the technology associated with the increase in the adoption of the technology. The finding of this study comes in consistent with the literature e.g. Lee (2004), Park (2009), Parveen and Suliman (2008), Jeberile (2003). This will be discussed in more detail in the discussion section.

Table (6-17): Correlation between adoption and ease of use

		Ease of use- factor analysis score 2	Adoption
Ease of use- factor analysis scor 2	Pearson Correlation	1	.294**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.294**	1
	Sig. (2-tailed)	.000	
	N	260	260

**. Correlation is significant at the 0.01 level (2-tailed).

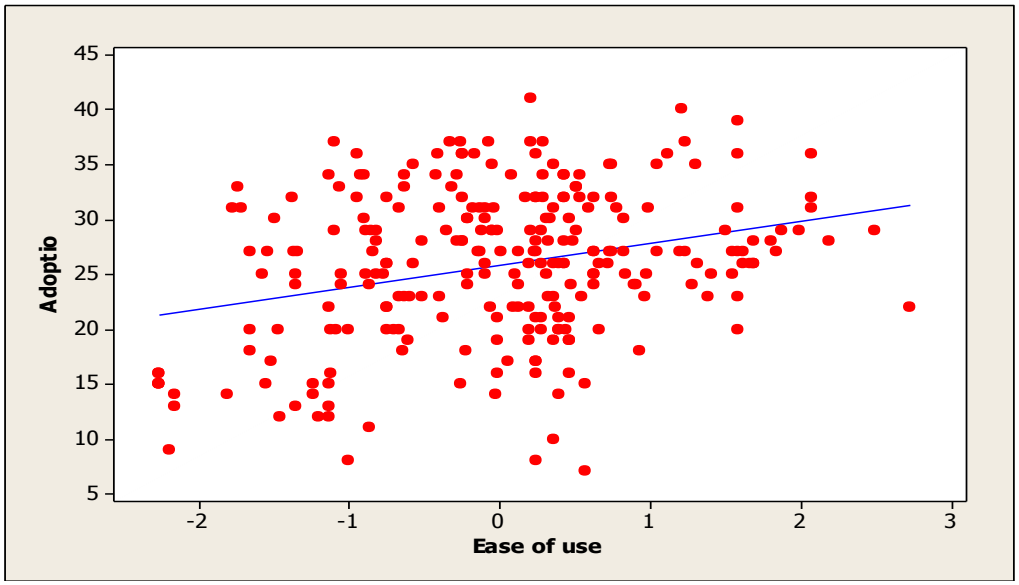


Figure (6-7): The relationship between adoption and ease of use

The relationship between IT adoption and Result Demonstrability

The correlation coefficient between the adoption and result demonstrability is shown in Table (6-18) below. It is clear from this table that the Pearson correlation coefficient is equal to 0.402, p=0.000. This means that the correlation coefficient is positive and has a statistical level of confidence less than p<0.01.

Table (6-18): Correlation between adoption and result demonstrability

		Result Demonstrability-factor analysis score	Adoption
Result Demonstrability-factor analysis score	Pearson Correlation	1	.402**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.402**	1
	Sig. (2-tailed)	.000	
	N	260	260

**. Correlation is significant at the 0.01 level (2-tailed).

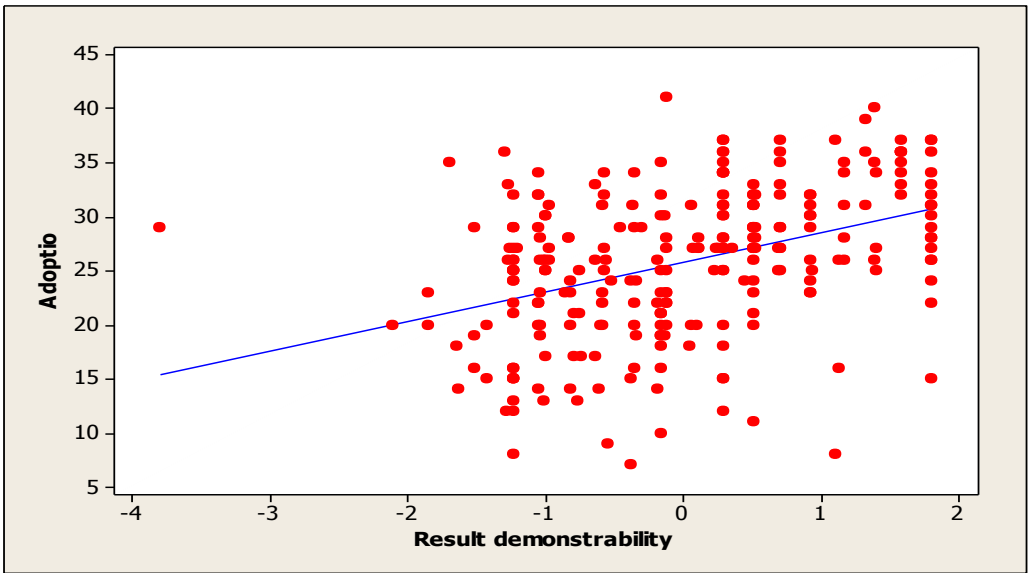


Figure (6-8): The relationship between adoption and result demonstrability

The relationship between adoption and result demonstrability has been drawn as shown in Figure (6-8) above. From this figure it can be seen that the more the managers are proud to demonstrate the obtained results from the use of the IT, the more adoption will be associated to this. Therefore, H_5 is accepted. The finding of this study is also comes in consistent with the literature e.g. Mahod et al (2005), Jebeile (2003) and Dong (2011). This will be discussed in more detail in the discussion section.

The relationship between IT adoption and Visibility

The correlation coefficient between the adoption and visibility is shown in Table (6-19) below. It is clear from this table that r=0.347 and *p*=0.000. This relationship is considered as medium. The relationship has been drawn as shown in Figure (6-9)

below. It is clear from Figure (6-9) that an increase in the independent variable visibility associated with an increase in the adoption of the IT. This means the more the visibility of the technology the more the IT adoption. This leads to accept H_6 hypothesis. The finding of this study comes in consistent with the literature e.g. Nan et al (2008), Jebeile (2003) and Rosner (1968). This will be discussed in more detail in discussion section.

Table (6-19): Correlation between adoption and visibility

		Visibility- factor analysis score	Adoption
Visibility- factor analysis score	Pearson Correlation	1	.347**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.347**	1
	Sig. (2-tailed)	.000	
	N	260	260

Correlation is significant at the 0.01 level (2-tailed).

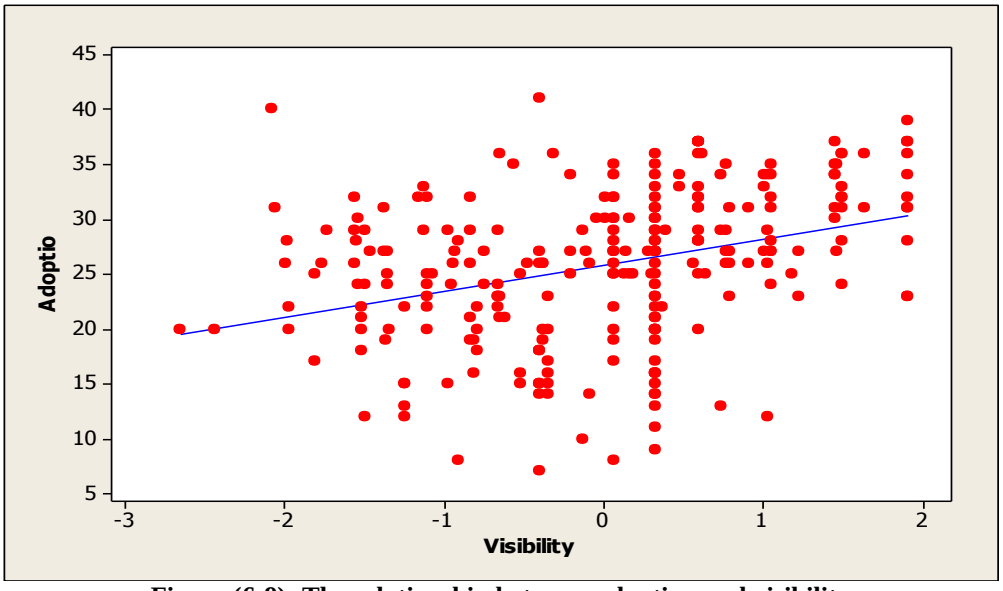


Figure (6-9): The relationship between adoption and visibility

The relationship between IT adoption and Trialability

The correlation coefficient between adoption and trialability is shown in Table (6-20) below. It is clear from this mentioned table that the coefficient is equal to 0.338, *p*=0.000 for the sample of 260 managers. The value of r here can be classified as medium Cohen (1988). The results indicate that the relationship between the two

variables is positive as shown in Figure (6-10). It is clear from Figure (6-10) that the more chances the managers have to try the IT systems, the more IT adoption associated with this activity. Therefore, H_7 is accepted. The findings of this study are also supported by the literature e.g. Tan et al (2011), Al-Gahtani (2003) and Mahmod (2000).

Table (6-20): Correlation between adoption and trialability

		Trialability- factor analysis score	Adoption
Trialability- factor analysis score	Pearson Correlation	1	.388**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.388**	1
	Sig. (2-tailed)	.000	
	N	260	260

**. Correlation is significant at the 0.01 level (2-tailed).

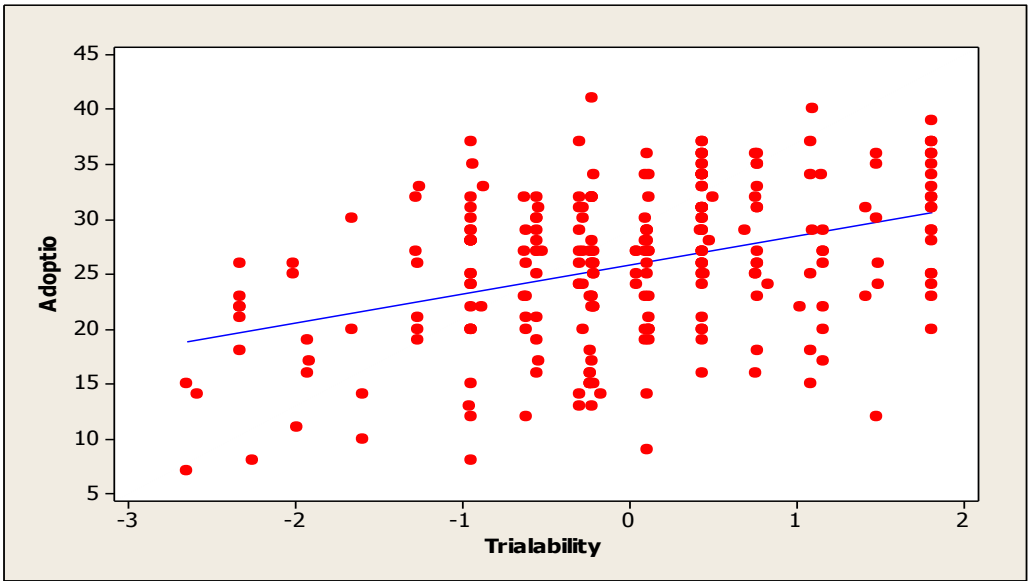


Figure (5-10): The relationship between adoption and trialability

The relationship between IT adoption and Facilitating Conditions

The correlation output between IT adoption and facilitating conditions is shown in Table (6-21) below. It is clear from this table that there is a positive relationship between the two variables, r= 0.362, *p*=0.000

Table (6-21): Correlation between adoption and facilitating conditions

		Facilitating conditions-factor analysis score	Adoption
Facilitating conditions-factor analysis score	Pearson Correlation	1	.362**
	Sig. (2-tailed)		.000
	N	260	260
Adoption	Pearson Correlation	.362**	1
	Sig. (2-tailed)	.000	
	N	260	260

**. Correlation is significant at the 0.01 level (2-tailed).

The relationship between the two variables is also drawn as shown in Figure (6-11) below. It is clear from this figure that an increase in facilitating conditions associated with an increase in the adoption of the technology. This means that the available resources help in creating environment of adoption to the IT systems. Therefore, H_8 will be accepted. The finding of this study is also supported by the literature e.g. Dong (2011) and Kijsanayotin et al (2009).

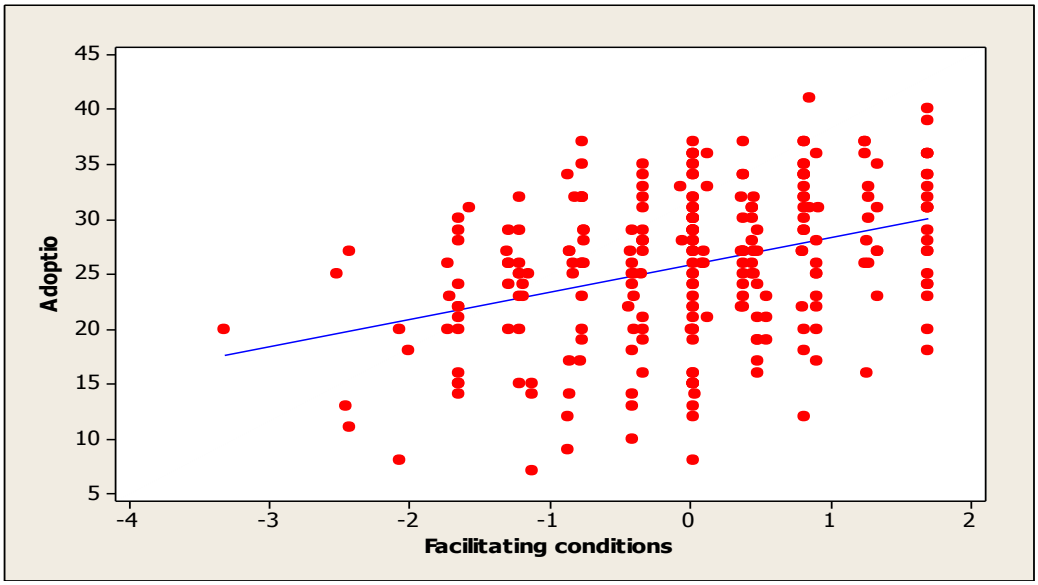


Figure (6-11): The relationship between adoption and facilitating conditions

The relationship between IT adoption and Subjective Norms

The correlation statistical test for the relationship between adoption and subjective norms is shown in Table (6-22) below.

Table (6-22): Correlation between adoption and subjective norms

		Adoption	Subjective norms-factor analysis score 2
Adoption	Pearson Correlation	1	.350**
	Sig. (2-tailed)		.000
	N	260	260
Subjective norms-factor analysis score 2	Pearson Correlation	.350**	1
	Sig. (2-tailed)	.000	
	N	260	260

**. Correlation is significant at the 0.01 level (2-tailed).

It is clear from this mentioned table that the value of the correlation coefficient r= 0.350, *p*=0.000. This means that the surrounding environment such as the organisations in the supply chain, peer organisations and government support help in the adoption of the IT in Libyan construction organisations. Figure (6-12) indicates that an increase in the subjective norms adoption factor results in an increase in the adoption of the IT systems. This means that there is a positive relationship between the two variables. Therefore, it can be concluded that H_9 can be accepted. The literature e.g. Park (2009) and Kijsanayotin et al (2009) supports this finding.

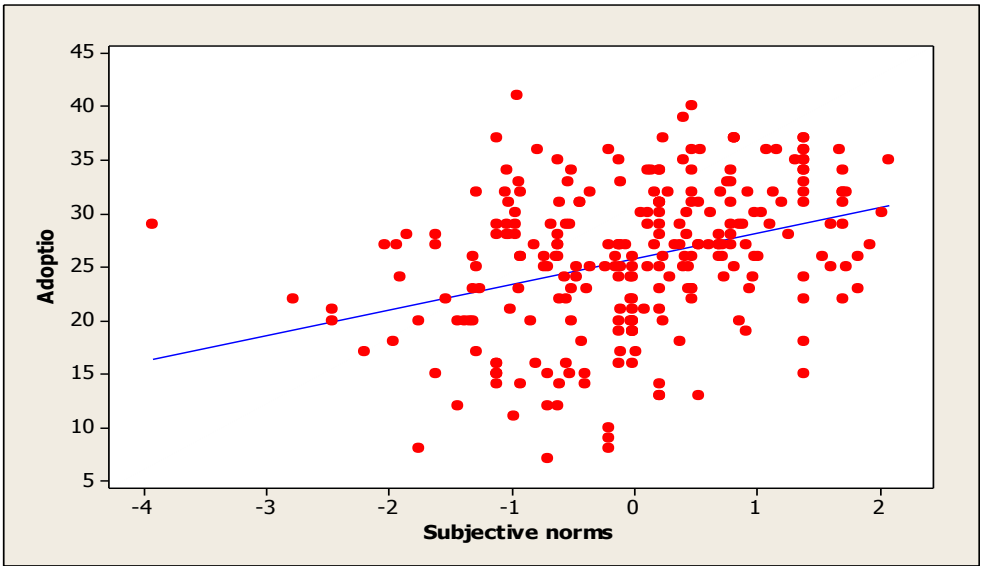


Figure (6-12): The relationship between adoption and subjective norms

6.6 Summary of the correlations analysis of the adoption & independent variables

The correlation coefficients between the adoption and all the 9 independent variables are shown in Table (6-23) below. It is clear from this mentioned table that all the correlation coefficients are positives and significant p= 0.000. It is clear from the table that result demonstrability has the highest correlation coefficient with adoption.

Table (6-23): Correlation between dependent and independent variables

R	RA	CO	IM	EU	RD	VI	TR	FC	SN
Adoption	0.265	0.351	0.382	0.294	0.402	0.347	0.388	0.362	0.350

Where,: RA= Relative advantage CO= Compatibility IM= Image
EU= Ease of use RD= Result demonstrability VI= Visibility
TR= Trialability FC= Facilitating conditions SN= Subjective norms

6.7 Results of hypothesises

The testing results of the hypothesis are summarised in Table (6-24) below. From the obtained results related to the relationships between the adoption and the 9 independent innovation factors considered in this study, it can concluded that all the hypothesis are accepted. This related to fact that all derived models show positive relationships between the IT adoption the innovation factors.

Table (6-24): Testing results of the hypothesis

No	Hypothesis	Accepted
H_1	There is a positive relationship between the IT adoption and the relative advantage of the IT system	Yes
H_2	There is a positive relationship between the IT adoption and the compatibility of IT system	Yes
H_3	There is a positive relationship between the IT adoption and the image of the organisation resulted from the adoption	Yes
H_4	There is a positive relationship between the adoption and the Ease of use	Yes
H_5	These is adoptive relationship between the IT adoption and the Result Demonstrability	Yes

H_6	There is a positive relationship between IT adoption and the visibility	Yes
H_7	There is a positive relationship between IT adoption and Trialability	Yes
H_8	There is a positive relationship between IT adoption and Facilitating conditions	Yes
H_9	There is a positive relationship between the IT adoption and subjective norms.	Yes

The next step is to derive a general innovation model between the adoption and the nine mentioned innovation factors. This can be achieved by using a multiple regression between these variables.

6.8 Multiple regressions between IT adoption and the independent variables

In the above regressions processes, only one independent variable has been used to find the relationship between the adoption and each of the independent variables. When the number of independent variables entered in the regression equation exceeds one, and then multiple regressions can be used to find the relationship between the dependent variable and the independent variables.

The problems in multiple regression is the multicollinearity and singularity, Pallant (2010, p.151). This refers to the relationship among the independent variables. According to Pallat (2010, p.151), multicollinearity exists when the independent variables are highly correlated (r=0.9 and above), while singularity occurs when one independent variable is actually a combination of other independent variables. This will affect the accuracy of the derived regression model. The problem of multicollinearity also highlighted by Bryman and Cramer (2009, p.300). The authors stated that 'the Pearson **r** between each pair of independent variables should not exceed 0.80; otherwise the independent variables that show a relationship at or excess of 0.80 may be suspected of exhibiting 'multicollinearity'. Multicollinearity regarded as a problem because it means that the regression coefficients may be unstable. This implies that they are likely to be subject of considerable variability from sample to sample. In many cases, when two variables are very highly correlated, there seems little point in treating them as separate entities. According to UNESCO.org (2011) if x_1 and x_2 are highly correlated (say correlation is greater than 0.9), then the simplest approach would be to use only one of them, since one variable conveys essentially all the information in the other variable, and the simplest method for detecting

multicollinearity is the correlation matrix, which can be used to detect if there are large correlations between pairs of explanatory variables.

In order to detect the multicollinearity which might exist between independent variables, the researcher has carried out the correlation test between the independent variables. The findings show that the maximum significant correlation coefficient (r) was found to have a value of 0.531, between facilitating conditions and trailability. Most correlation coefficients values between the independent variables were found to have values ranged from (0.2 to 0.4). It can be concluded from this finding that the effect multicollinearity is not significant.

6.9 Stepwise multiple regression between dependent and independent variables

The Stepwise multiple regression is one of the available methods to carryout multiple regression, Pallat (2010). A stepwise regression is a procedure to examine the impact of each variable to the model step by step, and the variable that cannot contribute much to the variance explained would be thrown out, Yu (2008). There are several versions of stepwise regression such as forward selection, backward elimination, and stepwise, Pallat (2010) and Yu (2008). These techniques were employed by many researchers such (e.g. June, 1997, Leigh, 1996) to determine the order of predictors by its magnitude of influence on the outcome variable. McCray et al (2004) used the stepwise multiple regression to analyze the semiconductor manufacturing process in US semiconductor industry. They found that the stepwise regression (SWR) is useful and can be used to analyse the semiconductor manufacturing process.

Stepwise regression technique had been used to conduct a multiple regression between the adoption and the nine independent predictors (i.e. relative advantage (RA), compatibility (CO), image (IM), ease of use (EU), result demonstrability (RD), visibility (VI), trialability (TR), facilitating conditions (FC) and subjective norms (SN)). The results of the regression can be shown in Table (6-25) and (6-26). Table (6-25) shows the summary of the regression model. It can be seen from this mentioned table that only four independent variables included in the model and these variables arranged according to their strength as follows:

Model-a	RD	R=0.402	(6-1)
Model-b	RD + SN	R=0.465	(6-2)
Model-c	RD+SN+ IM	R=0.504	(6-3)
Model-d	RD+SN+IM+FC	R=0.524	(6-4)

The values of the above correlation coefficients for the RD, SN, IM are significant at $p<0.001$ and FC is significant at $p<0.05$.It is also clear that RD is the most important variable in the equation since it has the highest correlation coefficient of 0.402. Table (6-26) also shows that all the coefficients included in the model are statistically significant.

The final model is Model-d shown above in equation (6-4). This model includes RD, SN, IM and FC and its R=0.524. This derived model will be used later in this chapter six to study the impact of the moderator variables on its focal variable RD. The moderator variables include 16 moderator variables as follows:

Seven moderator variables are related to adoption factors such as: voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, and business-level attitude toward IT adoption.

Nine moderator variables are related to the organisation and manager profiles such as: number of employees, type of business, time in business, type of organisation, availability of IT department, age of the manager, degree, speaking foreign language, and having a specific IT budget.

Table (6-25): Multiple regression model's summary

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.402[a]	.161	.158	6.28001	.161	49.665	1	258	.000
2	.465[b]	.216	.210	6.08381	.055	17.909	1	257	.000
3	.504[c]	.254	.245	5.94758	.038	12.908	1	256	.000
4	.524[d]	.275	.263	5.87483	.021	7.379	1	255	.007

a. Predictors: (Constant), Result Demonstrability-factor analysis score

b. Predictors: (Constant), Result Demonstrability-factor analysis score, Subjective norms-factor analysis score 2

c. Predictors: (Constant), Result Demonstrability-factor analysis score, Subjective norms-factor analysis score 2, Image- factor analysis score

d. Predictors: (Constant), Result Demonstrability-factor analysis score, Subjective norms-factor analysis score 2, Image- factor analysis score , Facilitating conditions- factor analysis score

Table (6-26): Multiple regression model coefficients

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
		B	Std. Error	Beta			Tolerance	VIF
1	(Constant)	25.846	.389		66.362	.000		
	Result Demonstrability-factor analysis score	2.750	.390	.402	7.047	.000	1.000	1.000
2	(Constant)	25.846	.377		68.503	.000		
	Result Demonstrability-factor analysis score	2.210	.399	.323	5.538	.000	.898	1.114
	Subjective norms-factor analysis score 2	1.689	.399	.247	4.232	.000	.898	1.114
3	(Constant)	25.846	.369		70.072	.000		
	Result Demonstrability-factor analysis score	1.592	.426	.233	3.733	.000	.751	1.331
	Subjective norms-factor analysis score 2	1.496	.394	.219	3.799	.000	.881	1.135
	Image- factor analysis score	1.503	.418	.220	3.593	.000	.781	1.281
4	(Constant)	25.846	.364		70.939	.000		
	Result Demonstrability-factor analysis score	1.344	.431	.196	3.120	.002	.718	1.393
	Subjective norms-factor analysis score 2	1.146	.410	.167	2.798	.006	.794	1.259
	Image- factor analysis score	1.388	.415	.203	3.341	.001	.773	1.294
	Facilitating conditions-factor analysis score	1.132	.417	.165	2.716	.007	.767	1.304

a. Dependent Variable: Adoption

On a separate exercise to make sure that the removed five variables from the model by the stepwise regression method have little effect on the derived model, the 'enter regression' method has been used for this purpose. The results of R are shown in Table (6-27) below.

Table (6-27): Comparing the results of stepwise and enter regression methods.

	R	No of independent variables entered in the equation
Stepwise method	0.524	4 variables
Enter method	0.549	9 variables

It can be seen from Table (6-27) that the difference in the values of R in both the stepwise regression method and the enter regression method is equal to 0.025. This means that the effect of the remaining five variables on the correlation coefficient which were removed in the stepwise regression method and entered in the 'enter method' increase the coefficient by 0.025 only. This is very small amount and therefore, the stepwise is more preferable than the entire method.

Table (6-28) below is derived from Table (6-26) which shows the beta coefficients of the independent variables in the derived IT model. The beta value tells the researcher how strongly is the independent variable associated with dependent variable. These values are equal to the correlation coefficient in simple linear regression. The values in Table (6-28) show that the image and result demonstrability have the highest values followed by the subjective norms and facilitating conditions respectively. It also shows that all the values are significant at the 0.01 level of significance. This means that the image of the organisation and result demonstrability have the highest effect on the IT adoption model. This will be discussed in section (6-10) below.

Table (6-28): Beta values from the multiple regression new

		Std. error	Beta	Sig.
1	Result demonstrability	0.431	0.196	0.002**
2	Subjective norms	0.410	0.167	0.006**
3	Image	0.415	0.203	0.001**
4	Facilitating conditions	0.417	0.165	0.007**

**. Correlation is significant at the 0.01 level (2-tailed)

6.10 Discussion

The descriptive figures show that most organisations sizes are within (1-600) employees and their businesses contracting/surveying, and most of them been in business (1-20years), over 50% private sector and over 80% have an IT department. This means that the construction organisations have in business for sometimes and most of are private organisations and the private organisations usually develop their selves to compete their competitors. As far as the manager profile is concerned the most important findings revealed that over 77.7% are Libyan managers, most of them their age ranged between (24 and 58 and most of the them > and more than 40 years), male, have higher degrees (BSc, Msc PhD) specialised in civil engineering, most of them graduated from Libya and can speak foreign language. This is very interesting findings. Usually the nationals of any country are more concerned about their country's future. As far as the use of the technology and their feeling about its relative advantage, compatibility with their businesses activities, their image resulted from the use of the technology, result demonstrability of the gain from the technology use, visibility of the technology in their premises, trailability of the technology before they adoption, facilitating conditions which supports their IT activities, and subjective norms (which is defined by Chismar and Wiley-Patton (2002)), as a person's feeling that people who are important to him think he should or should not use the technology. It can be concluded from the findings reveal that most managers are aware of the important of the technology to their business activities.

However in spite that the managers gave a positive picture about their awareness of the importance of the IT in their business activities, the interviews which were carried out with 26 managers (19 public organisations, 5 private organisations and 2 foreign organisations) highlighted many barriers and difficulties face their organisations such as: internet security, lack of skilled people, lack of education and training courses, Postal addresses barriers, lack of public awareness, lack of credit cards, weak banking system, lack of government regulations and lack of support to private sector, low foreign investment, cultural factor. These findings were also supported by studied carried out by Hamed (2009), Hunaiti et al (2009), Hamdy (2007) and Rhema and Miliszewska (2010) on the ICT adoption in Libya.

An interesting finding from this research results is that the IT adoption (independent variable) was found to have positive relationships with all the independent variables such as: relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms. This means that managers are aware of impact of the technology on their business activities. The relationships between the IT adoption and each of the independent variables are discussed below.

The relationship between the IT adoption and the Relative Advantage

The results of this study found a positive relationship between IT adoption and relative advantage. This means that the Libyan managers are no different from other managers in other countries in recognising the relative advantage of using the IT in improving their business activities. Both the quantitative (questionnaire) and qualitative (interviews) results obtained from the Libyan managers' indicated that relative advantage is important issue for their businesses. According to Rogers (1995), Garson (2006), El-Gohary et al (2007) understanding of the relative advantage of using the technology to the business activities is an important factor which could persuade managers and decision makers to adopt the new technology. The importance of the relative advantage factor has also been highlighted by researchers such as Cronin (1995), Abell and Lim (1996) and Benbasat (1991). Many researchers from different countries as shown in (table 4-3, chapter 4) such as Lee(2004), Nan et al (2008), Tan et al (2011), Duan et al (2010), Park (2009), Robetson (1990), Hussain (2009), Jebeile (2003) and Dong (2011) have shown positive relationship between IT adoption and relative advantage..

The relationship between the IT adoption and the Compatibility

Compatibility in this study was also found to have a positive relationship with the IT adoption and it comes in consistent with the literature Nan et al (2008), Lee (2004), Duan et al (2010), Al-Gahtani (2003) and Tan et al (2010). Compatibility is a cognitive issue and if a manager feels that the IT is compatible with the activities of his/her organisation then this could lead him/her to think for the adoption of an IT system. While Rogers (1983, 223) defined the compatibility 'as the degree to which using an innovation is perceived as consistent with the existing socio-cultural values and beliefs, past and present experiences, and needs of potential adopters'.

The relationship between the IT adoption and the Image

In this study it has been found that there is a positive relationship between the IT adoption and organisation image. This finding is consistent with literature, Nan et al (2008), Alessia et al (2009), Chen et al (2011) and Kim and Lee (2010). This means that the Libyan managers are aware of the impact of the IT adoption on image of their organisations.

Schultz (2007) in his discussion to the organisation image indicated that image is the perceptions that different people hold of an organization. Some perceptions derive from individual experiences and impressions of the organization, while others are influenced by the marketing and communication activities seeking to influence the image of the organization. Image is important for an organizations ability to attract and retain relationships with its different internal and external constituencies. Oladapo (2007), Yeomans (2005), IT Construction (2004) and Mui et al (2002) also highlighted the image as important innovation factor.

The relationship between the IT adoption and the Ease of Use

The relationship between the IT adoption and ease of use was found positive. In spite that the relationship between the IT adoption and the ease of use was found to be positive, the managers in the interviews highlighted that they lack the qualified personnel in the field of IT to support the Libyan organisations in their utilisation of the IT systems. The perception of the ease of use of an innovation is very important factor which affects the decision of the innovation adopters. Lorenzi (2011) pointed out that a significant number of major corporations and academic institutions now study human-computer interaction (HCI) and highlighted that many computer users argue that the computer makers are not paying enough attention to make the system 'friendly user'. The perception that the IT system is easy to use is a key factor affecting the user decision to adopt the system. The relationship between adoption and ease of use was highlighted by many researchers such as Davis (1989, 1993) when he derived Technology Acceptance model (TAM). It is also highlighted by Ugwu et al (2007), Walker and Peasupap (2004) and El-Gohary et al (2007). Researchers such as Nan et al (2008), Lee (2004), Park (2009), Parveen and Suliman (2008) and Jebeile (2003) found a positive relationship between IT adoption and ease of use. While Duan et al (2010) found a negative relationship between complexity and e-learning in the UK.

Tan et al (2011) found that the complexity of the ICT has a negative relationship with the ICT adoption in Malaysian SMEs and related this to lack of the technical skills and knowledge in the ICT field and in order to overcome this problem, the researchers recommended that these companies should hire the right technical personnel and provide training for all the staff members in these companies.

The relationship between the IT adoption and the Result Demonstrability

Result demonstrability has also shown a positive relationship with the adoption and got the highest correlation coefficient (0.402) in the simple linear regression analysis. Chismar and Wiley-Patton (2002) defined result demonstrability 'is the tangibility of the results of using the technology. Perceived ease of use both directly and indirectly impacts on perceived usefulness'. This means that the managers in Libyan construction organisations feel the benefits gained from the use of the IT adopted in their organisations. The finding of this study also supported by the literature such as Nan et al (2008), Non and Ye (2008), Mahod et al (2005), Jebeile (2003) and Dong (2011). For example, Mahmod et al (2005) studied the intention of e-learning by the Malay and Chinese 169 e-MBA students and found that result demonstrability influences the intention of potential user towards technology adoption for e-MBA

The relationship between IT adoption and the Visibility

The visibility was also found to have positive relationship with the adoption. Visibility defined by Moore and Benbasat (1991) as 'the degree to which the use of the personal work station (PWS) enhances the one's image or status within the organisation'.The importance of visibility also highlighted by other researchers such as Jebeile (2003) and The ITU (2001). Chirani et al. (2011, p.8595) defined visibility as 'the extent to which the benefits or attributes of the innovation are visible to prospective adopter'. While Jebeile (2003, p.15) indicated visibility examines how apparent or visible the use of the innovation is in the organisation or school context'. Jebeile (2003) carried out multiple regression between the ICT adoption and with seven innovation factors (relative advantage, compatibility, image, visibility, ease of use, results demonstrability, and trialability) to predict the dependent variable, teachers' future use of the Web for purposes of teaching

delivery. The researcher found a positive relation between visibility and the ICT adoption in the derived model.

This study has found a positive relationship between the IT adoption and the visibility innovation factor used in this study. The finding of this study is also supported by the literature findings such as Nan et al (2008), Jebeile (2003) and Rosner (1968).

The relationship between IT adoption and Trialability

The findings of this study indicate that there is a positive relationship between the IT adoption and trilability. This means that there is a change for the Libyan managers to try the technology before they decided to use. The finding of this study is also supported by the findings of the literature, Trialability gives the user a chance to try the technology before deciding to adopt it, Duan et al (2010), Tan et al (2011), Al-Gahtani (2003) Lee (2004).

Trialability defined by Moore and Benbasat (1991) as 'the degree to which it is possible to try using the personal work station PWS'. The trialability was introduced in the Rogers (1995) theory diffusion of innovation. The trailability is an important issue sine it gives the user the chance to try the system (software/hardware) before deciding to adopt it. This leads to user to guide how difficult the system is and what benefits can be gained from.

The relationship between IT adoption and Facilitating Conditions

The facilitating conditions construct was found to have a positive relationship with the IT adoption in Libyan construction organisations and this is also supported by the literature findings such as Datta (2011), Dong (2011) and Kijsanayotin et al (2009). In spite that there is a positive relationship between the IT adoption and facilitating conditions, the Libyan managers highlighted that there is shortage in available experienced technical skills and also the computer equipment needs to be updated. This is an important issue which should be considered by the decision maker in Libyan construction industry.

The facilities conditions was used by Rogers (1995) in developing his theory of innovation and also used by Venkatesh et al (2003) as construct in developing their

UTAUT. The facilitating conditions defined as '*The degree to which an individual believes that an organisational and technical infrastructure exists to support use of the system'.* Venkatesh et. Al (2003). Data (2011, p.7) defined the facilitating conditions as '*facilitating conditions refer to objective conditions that can enhance adoption; compatibility is the perception of consistency between what is offered by the technology and the user's immediate resources and values'*. Datta (2011) discussed factors affecting the adoption dynamics of technologies among 172 e-commerce users in 73 developing countries and found that the facilitating conditions play a critical moderating role in understanding actual e-commerce adoption.

The relationship between the IT adoption and Subjective Norm

The subjective norm in this study was also found to have a positive relationship with the IT adoption. This means that the managers in Libyan construction organisations have the perception that the people who are important to them think they should or should not use the technology. The finding of this study also supported by the literature, e.g. Park (2009) and Kijsanayotin et al (2009).

Subjective norm is defined as a person's perception that people who are important to him think he should or should not use the technology Chismar and Wiley-Patton (2002). The importance of the subjective norm as an IT adoption factor was highlighted by Fishbein and Ajzen, (1975) and Kijsanayotin et al (2009) Kautz and Pries-Heje (1996). Kautz and Pries-Heje (1996) Venkatesh et al (2003) and Sun and Zhang (2006) indicated that the subjective norm has an effect on both the usage and attitude toward the technology.

6.11 Conclusions

The main conclusions from this chapter are as follows:

1. The reliability statistical tests have shown that the dependent and independt variables have accepted values of Cronbach's Alpha coefficients. This means that the questioonare instrument is reliable and can be used with confident.

2. The ANOVA tests have shown that most of the independent variables have shown significant differences between the means of the responses to the six scale questioonare. This is expected since those managers have different educational background and experiences and could affect their responses.

3. IT-adoption was found to have positive relationship with all the nine innovation factors considered in this study (relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms). The finding of this study is also supported by the literature.

4. The statistical tests show that in spite there is a positive relationship between IT adoption and each of the nine independent factors, their correlation coefficients as shown in Table (6-23) could be considered as ranging between (small to moderate) values, Choen (1988). The result demonstrability has the highest correlation coefficient of 0.402 and the relative advantage has the lowest value of 0.265. This means that in spite the managers are proud to demonstrate to their partners in their supply chain /friends what the technology can offer to their business activities, they are still facing some obstacles and problems such as the lack of skilled workforce, lack of training courses, lack of incentive schemes, security of information, banking systems, lack of regulations and son. These issues have been highlighted by the managers in their interviews.

5. Stepwise multiple-regression has been carried out to find the relationship between the IT adoption and the 9 independent variables. The final equation derived shows that the IT adoption depends on the result demonstrability, image, facilitating conditions and subjective norms. The correlation coefficient of the derived equation was found to equal to 0.524. The other factors were dropped

from the model due to their slight effect of the derived model. In order to make sure that the derived model can predict the IT adoption, the researcher used 'enter regression method' and the found results indicate that only slight increase in the value of the correlation coefficient (increase from 0.524 to 0.549) as shown in Table (6-27). This means that the five independent variables which were dropped from the model have very slight effect on the derived original IT adoption model.

6 In the next chapter i.e. Chapter 7 the researcher will explore the impact of 16 moderator variables such as: voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, business-level attitude toward IT adoption, number of employees, type of business, time in business, type of organisation, availability of IT department, degree, speaking foreign language and having IT budget.

Chapter Seven: Impact of the Moderating Factors on the IT adoption and discussions

7.1 Introduction

This chapter explores the effect of the moderator variables on the IT adoption model derived in chapter six. The chapter includes the analysis of the moderator variables. The analysis includes, reliability of the IT moderator factors, one way ANOVA analysis of the moderating variables, factor analysis of the IT moderator variables, moderator variables and innovation models, types of moderator variables, moderator variables-theoretical background, hypothesis related to the moderator variables, MODPROPE –fundamental principles', statistical analysis of the moderator variables, summary of the tested moderator variables, results of the moderator hypothesis and discussions and conclusions.

7.2 Moderator variables

This part of the chapter deals with moderator variables and their effect on the adoption multiple regression model derived in the previous chapter. The conceptual model of this research is shown in Figure (7-1) below. It can be seen from Figure (7-1) that there are 16 moderator variables to be studied and find their effect. These variables belong to three categories: IT adoption factors, managers' variables and organisation variables.

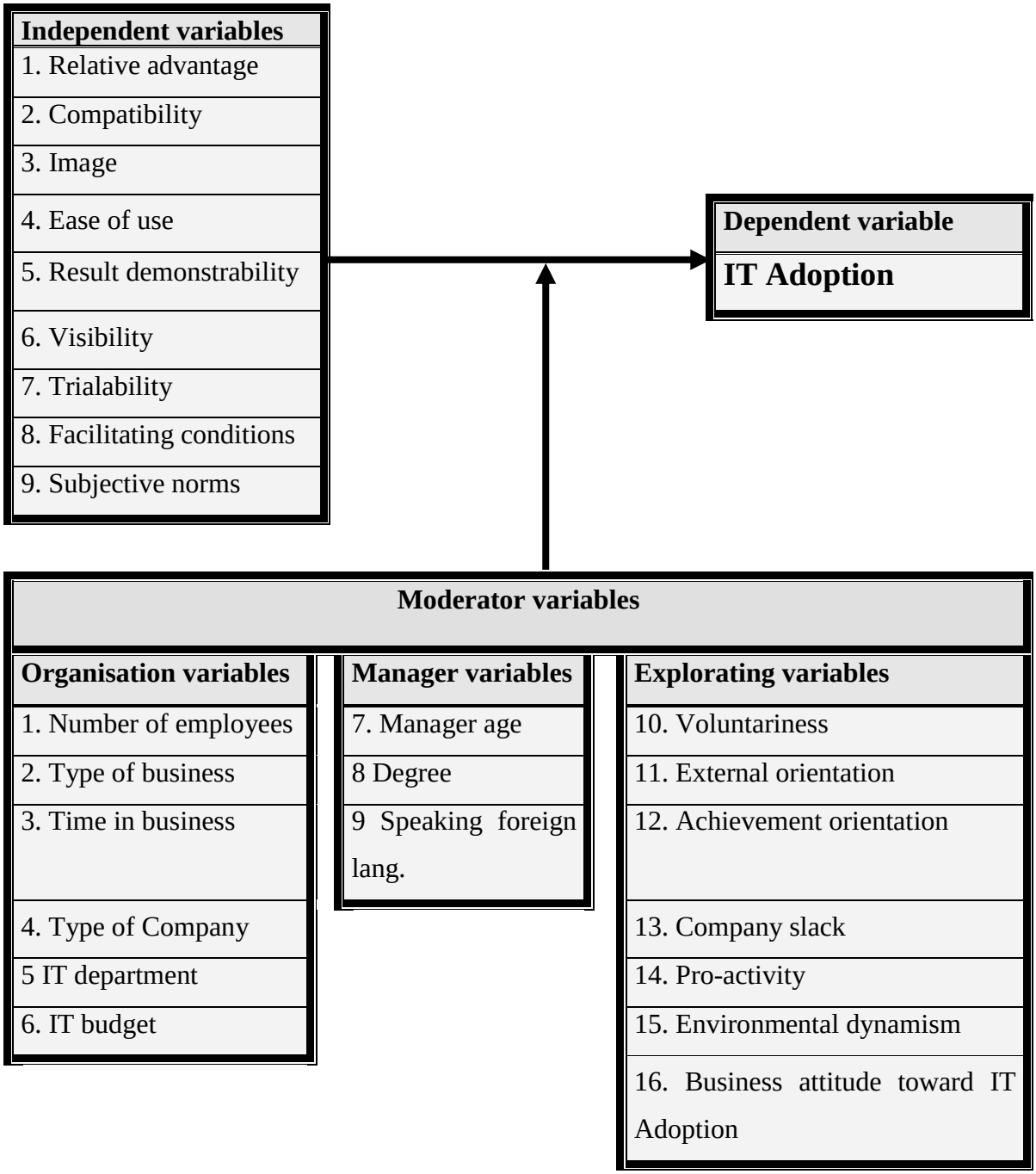


Figure (7-1): Conceptual model for this research

7.3 Analysis of the IT moderator factors and their variables

The effect of 16 IT moderator adoption factors on the adoption of the IT systems will be investigated in this chapter. As it is shown in the conceptual model that there are three categories of moderator variables. These variables are related to the 7 IT factors, (voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, and business attitude toward IT adoption.

While the managerial variables (4 variables) are related to the age of the manager, degree, ability of speaking foreign language and having a specific IT budget. The organisational variables (5 variables) include number of employees (i.e size of the organisation), type of business, time in business (age of the organisation), type of organisation (i.e. public/private/foreign) and having an IT department. The description statistics of both the managerial and organisational were carried out earlier in this chapter under the profiles managers and organisations headings.

In this section the researcher will discuss the 7 IT moderator factors and their variables. These factors are shown in Table (7-1) which include voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, business-level attitude toward IT adoption.

Table (7-1): IT adoption moderator factors and their variables.

No	Moderating variables	Number of questions
1	Voluntariness	4
2	External orientation	7
3	Achievement orientation	2
4	Company slack	3
5	Pro-activity	3
6	Environmental dynamism	5
7	Business-level attitude toward IT adoption	4
	Total	29 questions

7.3.1 Reliability analysis of the IT moderator factors

The reliability tests were carried out using SPSS to find the values of Cronbach's Alpha. Nunnally (1967, p. 226) suggested that reliabilities values between 0.50 to and 0.60 are sufficient for basic research. The values of Alpha are shown in Table (7-2) below. It is clear from this table that the values of alpha for all the constructs lie between 0.599 and 0.850. Hair et al (2006, p.777) indicated that different reliability coefficients do not produce dramatically different results. While Foster (2001, p.228) pointed out that high reliability is not always a ‘good thing’. It can be said that reliability still remains as an important indicator to assess the research constructs. The organisation and manager profiles were not assessed since each one construct consists of one question.

Table (7-2): Reliability of the moderator variables

No	Construct	No of variables	Cronbach's Alpha
	IT moderators		
1	Voluntariness	4	0.698
2	External orientation	7	0.814
3	Achievement orientation	2	0.633
4	Company slack	3	0.844
5	Pro-activity	3	0.559
6	Environmental dynamism	5	0748
7	Business –level attitude toward IT adoption	4	0.850

7.3.2 One Way ANOVA analysis of the moderating variables

One way ANOVA has been carried out to 7 exploring IT moderator factors and 9 moderating variables related to the manager and the organisation. The results of the tests are shown in Table (7-3) below. It is clear from the mentioned table that most of explorating IT moderator variables have shown significant differences between the groups responses. The mentioned table also shows that from the manager moderating variables only speaking foreign language was found to be statistically significant. Table (7-3) also shows that from the organisation moderating variables only number of employees and type of company were found to be statistically significant.

Table (7-3): One way ANOVA results of the moderator variables.

	Question	
H	**Voluntariness**	Sig.
H-1	Our clients expect us to use IT	0.009
H-2	Our use of IT is voluntary (as opposed to required by our stakeholders or job description)	0.000
H-3	The government does not require us to use IT	0.000
H-4	Although it might be helpful, using IT is certainly not compulsory in our job	0.000
I	**External orientation**	
I-1	Our business objectives are driven primarily by clients satisfaction	0.045
I-2	We constantly monitor our level of commitment and orientation to serving our clients' needs	0.000
I-3	Our strategy for competitive advantage is based on our understanding of clients' needs	0.000
I-4	Our business strategies are driven by our beliefs about how we can create greater value for clients	0.000
I-5	We measure clients' satisfaction systematically and frequently	0.000
I-6	We give close attention to after-service contact with our clients	0.000
I-7	All of our managers understand how everyone in our company can contribute to creating client value	0.000

J	**Achievement orientation**	
J-1	Achievement of goals has a very important place here	0.007
J-2	Being the leader in our field is very important here	0.044
K	**Company slack**	
K-1	There is generally no scarcity of financial resources for capital projects	0.000
K-2	There is usually abundant availability of required labour skills within our company	0.000
K-3	There is usually no shortage of managerial talent to effectively run our company	0.000
L	**Pro-activity**	
L-1	Typically, our company responds to actions that competitors initiate	0.000
L-2	Our company is very seldom the first business to introduce new products or technologies	0.061
L-3	Typically, Our company seeks to avoid competitive clashes, preferring a "live-and-let-live" posture	0.011
M	**Environmental dynamism**	
M-1	Our company must change its marketing practices extremely frequently	0.080
M-2	The rate at which the products/services are becoming obsolete in the industry is very slow	0.105
M-3	Actions of competitors are quite easy to predict	0.034
M-4	Demand and consumers tastes are fairly easy to forecast	0.180
M-5	The production/service technology is not subject to very much change and is well established	0.027
O	**Business-Level Attitude Toward IT Adoption**	
O-1	The CEO strongly recognizes that IT enhances the company profitability	0.000
O-2	The CEO has high awareness of IT	0.001
O-3	Senior management strongly recognizes that that IT can enhance company competitiveness	0.002
O-4	Senior management has good awareness of IT	0.000
	Manager moderating variables	Sig.
1	Age	0.245
2	Degree	0.628
3	Speaking foreign language	0.000
	Organisation moderating variables	Sig.
1	Number if employees	0.043
2	Type of business	0.771

3	Time in business	0.364
4	Type of company	0.000
5	Having an IT department	0.389
6	Having an IT budget	0.175

An example from the moderating factor 'Voluntariness-H-1' ANOVA output has been selected for illustration as shown in Tables (7-4) and (7-5) below.

Table (7-4): ANOVA output of moderator 'Voluntariness-H-1'

ANOVA

Adoption

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	703.751	5	140.750	3.128	.009
Within Groups	11430.095	254	45.000		
Total	12133.846	259			

It is clear from the above mentioned table that differences between and within groups is significant (*p= 0.009, which is less than 0.05*). This is expected since the managers have different educational backgrounds and different ages which have direct effect on their responses to IT adoption in Libyan construction industry.

Table (7-5) below shows the multiple comparisons of means of the moderator 'Voluntariness- H-1'. It is clear from the mentioned table there is only significant difference between 'strongly disagree' and 'slightly disagree' (*p= 0.04 which is less than the significant level of 0.05).*

Table (7-5): ANOVA output 'Voluntariness-H-1' multiple comparisons

Multiple Comparisons- Tukey HSD

(I) Our clients expect us to use IT	(J) Our clients expect us to use IT	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Strongly disagree	Disagree	1.86934	.94661	.360	-.8490	4.5876
	Slightly disagree	4.11305*	1.39305	.040	.1128	8.1133
	Slightly agree	.29487	3.43904	1.000	-9.5807	10.1705
	Agree	-2.20513	4.80386	.997	-15.9999	11.5897
	Strongly agree	-9.70513	4.80386	.334	-23.4999	4.0897
Disagree	Strongly disagree	-1.86934	.94661	.360	-4.5876	.8490
	Slightly disagree	2.24371	1.29723	.513	-1.4814	5.9688

	Slightly agree	-1.57447	3.40136	.997	-11.3418	8.1929
	Agree	-4.07447	4.77696	.957	-17.7920	9.6431
	Strongly agree	-11.57447	4.77696	.152	-25.2920	2.1431
Slightly disagree	Strongly disagree	-4.11305*	1.39305	.040	-8.1133	-.1128
	Disagree	-2.24371	1.29723	.513	-5.9688	1.4814
	Slightly agree	-3.81818	3.55158	.891	-14.0169	6.3806
	Agree	-6.31818	4.88506	.789	-20.3462	7.7098
	Strongly agree	-13.81818	4.88506	.056	-27.8462	.2098
Slightly agree	Strongly disagree	-.29487	3.43904	1.000	-10.1705	9.5807
	Disagree	1.57447	3.40136	.997	-8.1929	11.3418
	Slightly disagree	3.81818	3.55158	.891	-6.3806	14.0169
	Agree	-2.50000	5.80950	.998	-19.1826	14.1826
	Strongly agree	-10.00000	5.80950	.519	-26.6826	6.6826
Agree	Strongly disagree	2.20513	4.80386	.997	-11.5897	15.9999
	Disagree	4.07447	4.77696	.957	-9.6431	17.7920
	Slightly disagree	6.31818	4.88506	.789	-7.7098	20.3462
	Slightly agree	2.50000	5.80950	.998	-14.1826	19.1826
	Strongly agree	-7.50000	6.70823	.874	-26.7634	11.7634
Strongly agree	Strongly disagree	9.70513	4.80386	.334	-4.0897	23.4999
	Disagree	11.57447	4.77696	.152	-2.1431	25.2920
	Slightly disagree	13.81818	4.88506	.056	-.2098	27.8462
	Slightly agree	10.00000	5.80950	.519	-6.6826	26.6826
	Agree	7.50000	6.70823	.874	-11.7634	26.7634

*. The mean difference is significant at the 0.05 level.

Table (7-6) and Table (7-7) shows the ANOVA output of number of employees. It is clear that there is significant differences between groups the categories (>1000, 1-200, 201-400, and 401-600 employees. This is could be related to the organisation resources. This will be discussed later in more detail in this chapter.

Table (7-6): ANOVA output for number of employees

ANOVA Adoption

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1196.805	5	239.361	5.559	.000
Within Groups	10937.041	254	43.059		
Total	12133.846	259			

Table (7-7): ANOVA mean comparisons of number of employees

Tukey HSD

(I) Number-of-emp-categories	(J) Number-of-emp-categories	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
(1-200) employees	(201-400) employees	-.71847	1.12339	.988	-3.9444	2.5075
	(401-600) employess	-.28307	1.34588	1.000	-4.1479	3.5818
	(601-800) employees	-2.39729	1.95418	.823	-8.0089	3.2144
	(801-1000) employees	-3.14454	2.58029	.827	-10.5541	4.2650
	>1000 employees	-5.22805*	1.08122	.000	-8.3329	-2.1232
(201-400) employees	(1-200) employees	.71847	1.12339	.988	-2.5075	3.9444
	(401-600) employees	.43541	1.43536	1.000	-3.6864	4.5572
	(601-800) employees	-1.67881	2.01685	.961	-7.4704	4.1128
	(801-1000) employees	-2.42607	2.62807	.940	-9.9728	5.1207
	>1000 employees	-4.50958*	1.19075	.003	-7.9289	-1.0902
(401-600) employees	(1-200) employees	.28307	1.34588	1.000	-3.5818	4.1479
	(201-400) employees	-.43541	1.43536	1.000	-4.5572	3.6864
	(601-800) employees	-2.11422	2.14874	.923	-8.2845	4.0561
	(801-1000) employees	-2.86147	2.73059	.901	-10.7027	4.9797
	>1000 employees	-4.94499*	1.40260	.007	-8.9727	-.9173
(601-800) employees	(1-200) employees	2.39729	1.95418	.823	-3.2144	8.0089
	(201-400) employees	1.67881	2.01685	.961	-4.1128	7.4704
	(401-600) employees	2.11422	2.14874	.923	-4.0561	8.2845
	(801-1000) employees	-.74725	3.07629	1.000	-9.5811	8.0866
	>1000 employees	-2.83077	1.99366	.715	-8.5558	2.8943
(801-1000) employees	(1-200) employees	3.14454	2.58029	.827	-4.2650	10.5541
	(201-400) employees	2.42607	2.62807	.940	-5.1207	9.9728
	(401-600) employees	2.86147	2.73059	.901	-4.9797	10.7027
	(601-800) employees	.74725	3.07629	1.000	-8.0866	9.5811
	>1000 employees	-2.08352	2.61032	.968	-9.5793	5.4123
>1000 employees	(1-200) employees	5.22805*	1.08122	.000	2.1232	8.3329
	(201-400) employees	4.50958*	1.19075	.003	1.0902	7.9289
	(401-600) employees	4.94499*	1.40260	.007	.9173	8.9727
	(601-800) employees	2.83077	1.99366	.715	-2.8943	8.5558
	(801-1000) employees	2.08352	2.61032	.968	-5.4123	9.5793

*. The mean difference is significant at the 0.05 level.

7.3.3 Factor analysis of the IT moderator factors

According Hedderson (1991,.p.172) factor analysis is a technique usually used to condense many variables into a few underlying constructs. Factor analysis has been carried out for the moderator variables such as voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism and business-level attitude toward IT adoption. The analysis is shown in Table (7-8) below. Table (7-8) also showed Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and also the Bartlett's test of sphericity and its significance. It is clear from the results that the (KMO) test indicates that the sample is adequate. The Bartlett's test of sphericity is also significant p=0.000. The table also shows number of factor analysis components which indicates that all the constructs have one 1 component except the voluntariness and external orientation each has 2 components.

Table (7-8): Factor analysis for the moderator variables

Construct	Kaiser-Meyer-Olkin Measure of Sampling Adequacy	Bartlett's Test of Sphericity	Principal Component Analysis	
			Initial Eigenvalues (Cumulative %)	No of Component(s) extracted
VO	0.629	0.000	84.328	2
EO	0.825	0.000	66.003	2
AO	0.500	0.000	74.162	1
CS	0.719	0.000	76.288	1
PR	0.521	0.000	48.415	1
ED	0.772	0.000	52.233	1
PL	0.803	0.000	69.230	1

VO= Voluntariness

EO= External orientation

AO= Achievement orientation

CS=Company slack

PR= Pro-activity

ED= Environmental dynamism

BA=Business-level attitude toward IT adoption

7.4 Moderator variables and innovation models

Using the moderator variables in innovation and adoption field is not a new idea. Venkatesh et al (2003) in their UTAUT model which was based on the assessment of

eight most available models innovation models such as (DoI, TAM, TRA, MM, TPB, C-TAM-TPM, MPCU, SCT). The UTAUT model consists of four factors which are: Performance expectancy, Effort expectancy, Social influence and the facilitating conditions (Figure-2-4, Chapter2). Three of these of factors are (i.e. the performance expectancy, efforts expectancy and social influence have a direct impact on the behavioural intension). The use behaviour in turn influenced by the behaviour intension to use and also by the fourth factor (i.e. facilitating conditions). The actual impact of the four factors is influenced by four moderators (*gender, age, experience and voluntariness of use*). The proposed model has been positively reviewed by researchers such as Anderson and Schwager (2004) and Lackey (2004. Elias et al (2010) studied that attitudes of the employees toward the technology and they used age of the employee employees as moderator.

Mostafa (2005) carried out a study to investigate the perceived creativity and innovativeness in Egyptian organisations. The study revealed that the greater the education of manager, the more he/she is likely to adopt creative and innovative activities. The education factor could be considered as a moderator in this regard.

However, Lee and Xia (2006) studied the relationship between the organisation size and IT adoption and found that the relationship is moderated by five moderators such as: type of IT innovation, type of organisation, stage of adoption, scope of size, and type of size measure.

7.5 Moderator variables: theoretical background

Bennett (2000,p.416) defined a moderator as ‘an independent variable that affects the strength and/or direction of the association between another independent variable and an outcome variable as illustrated in Figure (7-2) below.

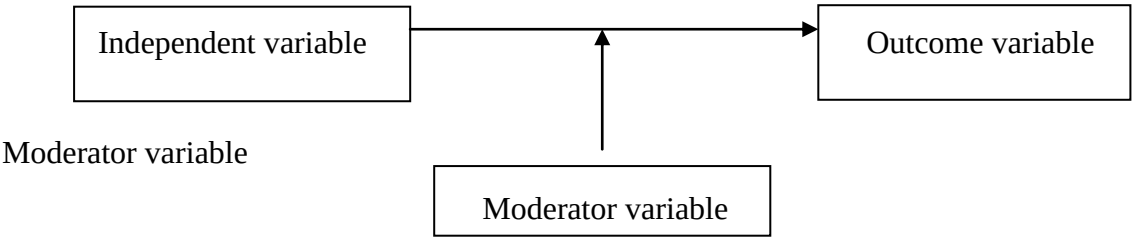


Figure (7-2): Conceptual model of a moderator effect, Bennet (2000)

Louis (2009, p.1) defined the moderator as follows **‘**It is a variable that changes the relationship between an Independent variable (IV) and a Dependent variable (DV). A significant interaction between the moderator and the IV means that the effect of the

IV on the DV changes depending on the level of the moderator. In multiple regression, we say that the simple slope of the IV on the DV changes depending on the level of the moderator, and with continuous moderators we generally compare "high" levels of the moderator (+1 standard deviation above the mean) to "low" levels (-1 SD below the mean)'

Kenny (2009) and Hayes and Mathes (2009) indicated that the impact of the moderating variable usually measured by the interaction between the independent and the moderating variable. This will be explained in more details later in this chapter.

According to Zedeck (1971) and Sharma et al (1981), in applying Moderated Regression Analysis (MRA) in terms of one predictor variable, the following equations should be examined.

$$\boldsymbol{Y = a + b_1 X} \quad (7\text{-}1)$$

$$\boldsymbol{Y = a + b_1 X + b_2 Z} \quad (7\text{-}2)$$

$$\boldsymbol{Y = a + b_1 + b_2 Z + b_3 XZ} \quad (7\text{-}3)$$

Equation (7-1) is a simple linear regression model between the dependent variable Y and independent variable $\boldsymbol{X}$ without moderation.

Assume $\boldsymbol{Y}$ the dependent variable

Assume $\boldsymbol{X}$ the independent variable

$\boldsymbol{Z}$ is the moderator variable

$\boldsymbol{a}$ = intercept

$\boldsymbol{b_1, b_2, b_3}$ = Coefficients (slopes)

Equation (7-2) and (7-3) represent the relationships between the dependent variable Y and both independent variable $\boldsymbol{X}$ and the moderating variable $\boldsymbol{Z}$. The difference between equation (7-2) and (7-3) is that equation (7-3) includes the independent variable $\boldsymbol{X}$ and the moderating variable $\boldsymbol{Z}$ interaction (i.e XZ) and its regression coefficient b_3 (i.e the slope). Zedeck (1971), Sharma et al (1981) indicated that the following conditions for a variable to a moderator:

1. **<u>If equation (7-2) and equation (7-3)</u>** are ***not*** significantly different (i.e. b_3= =0; $b_2 \neq 0$) **<u>Z is *not* a moderator variable *but* it is simply an *independent predictor*</u>**.

2. **For Z to be a <u>pure moderator</u> variable**, equations (7-1) and (7-2) should not be different from equation (7-3), (i.e. b_2=0 ; $b_3 \neq 0$).
3. **For Z to be a classified as quasi moderator,** equations (7-1) and (7-2) and (7-3) should be different from each other (i.e. $b_2 \neq 0$; $b_3 \neq 0$).

Kenny (2009) in his discussion to the impact of the moderating variables on the multiple regression such as in equation (7-3) above, agrees with Zedec in that if $\mathbf{b_3}$ is **<u>not statistically significant</u>**, then **Z** is **<u>not a moderator variable</u>**, it is just independent variable. If ***<u>b_3 is statistically significant</u>***, then Z will be a moderator variable.

Bennet suggested the following steps to assess the moderator effect as shown in Figure (7-3) below.

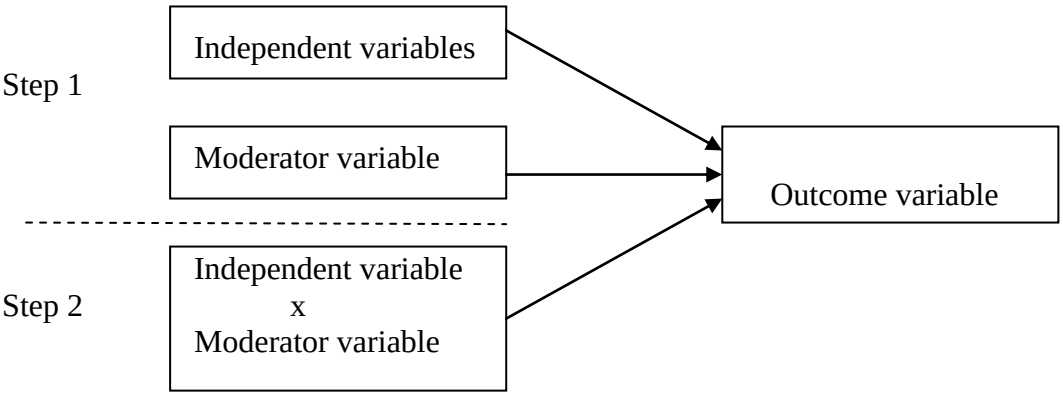


Figure (7-3): Statistical model of a moderator effect, Bennet (2000)

Bennet (2000) suggested that in the first step or (steps) of the regression, the independent variables (including the moderator) are entered into the model as predictors of the outcome variable. The independent variables do not have to be significant predictors of the outcome variable in order to test for an interaction term in the next step. In a separate step, an interaction term (the product of two independent variables, which represents the moderator effect entered). If the interaction term

explains a statistically significant amount of variance in the dependent variable, a moderator effect is present.

In their discussion to the effect of the moderator variable, Hair et al (2006, p. 201) stated that "if an independent-dependent variable relationship is affected by another independent variable, this situation is termed *moderator effect*, which occurs when the moderator variable, a second independent variable, changes the *form* of the relationship between another independent variable and the dependent variable. This is also known as interaction *effect* and is similar to the interaction term found in the analysis of the variance and multivariate analysis of variance.

According to Hair et al (2006, p.202) the moderator effect is represented in multiple regression in a similar way to that of the nonlinear effect. The moderator variable formed by multiplying X_1 by X_2 which interred into the regression. To find out the whether the moderator effect is significant, Hair et al (2006, p.202), suggested three steps to be followed:

1. Estimate the original (**unmodified) equation**
2. Estimate the **moderated relationship** ((original equation plus moderator variable)
3. Assess the **change in R^2** : ***if it is statistically significant***, **then a significant moderator effect is present**. Only the incremental effect is assessed, not the significance of individual variables.

Hayes and Matthes (2009) have introduced software called MODPROBE to assess the effect of the moderator variables in linear model. The software is compatible with the SPSS software and therefore, it is easy to bring data from SPSS to the MODPROBE. The researcher will use the MODPROBE to examine the effect of the moderator variables on the adoption model derived in chapter six. This will be explained in detail this chapter.

7.6 Hypothesise related to the effect of the moderator variables

Hypotheses related to the impact of the **moderating variables** on the adoption derived general model.

H_{10}: The voluntariness factor moderates the relationship between the adoption and independent variables in their derived general model

H_{11}: The external orientation factor moderates the relationship between the adoption and independent variables in their derived general model

H_{12}: The achievement factor moderates the relationship between the adoption and independent variables in their derived general model

H_{13}: The company slack factor moderates the relationship between the adoption and independent variables in their derived general model

H_{14}: The pro-activity factor moderates the relationship between the adoption and independent variables in their derived general model

H_{15}: The environmental dynamism factor moderates the relationship between the adoption and independent variables in their derived general model

H_{16}: The business-level attitude toward IT adoption factor moderates the relationship between the adoption and independent variables in their derived general model

H_{17}: Having a specific IT budget moderates the relationship between the adoption and independent variables in their derived general model

These hypothesise are related to the organisation and managers profiles as moderating variables.

H_{18}: Number of employees moderates the relationship between the adoption and independent variables in their derived general model

H_{19}: Type of business moderates the relationship between the adoption and independent variables in their derived general model

H_{20}: Time in business moderates the relationship between the adoption and independent variables in their derived general model

H_{21}: Type of company moderates the relationship between the adoption and independent variables in their derived general model

H_{22}: Having an IT department moderates the relationship between the adoption and independent variables in their derived general model

H_{23}: Age of manager moderates the relationship between the adoption and independent variables in their derived general model

H_{24}: Degree moderates the relationship between the adoption and independent variables in their derived general model

H_{25}: Speaking of foreign language moderates the relationship between the adoption and independent variables in their derived general model

7.7 MODPROBE fundamental principles

MODPROBE was introduced by Hayes and Matthes (2009). MODPROBE is a moderation technique for investigating single degree of freedom interaction in ordinary least squares (OLS), Polat (2010). According to Hayes and Matthes (2009) the moderation effect of focal variable F (by its size and direction) on the outcome variable Y depends on the value of a third moderator variable M. according to Jaccard and Turrisi (2003) and Polat (2010), the focal independent variable is the variable in which its effect on the dependent variable is thought to vary as a function of the moderator variable.

In a linear model a set of k predictor variables is used to model some outcome variable Y can be written as shown equation (7-4) below, Hayes and Matthes (2009).

$$\boldsymbol{Y = a + b_1 F + b_2 M + \sum_{i=3}^{k} b_i W_i} \qquad (7\text{-}4)$$

Where

Y = is the estimate of the outmen variable

a = intercept

F= = is the focal variable

M = is the moderator variable

W = is one or more additional predictor variables that added to the model

b1, b2 = constants

k = number of predictor variables

Equation (7-4) above cannot detect the effect of moderator variable on the focal since there is no interaction between the two variables.

When the interaction term is added to equation (7-4) then the equation can be re-written in the form as shown in equation (7-5), Hayes and Matthes (2009).

$$\boldsymbol{Y = a + b_1 F + b_2 M + b_3 (F_X M) + \sum_{i=4}^{k+1} b_i W_i} \qquad (7\text{-}5)$$

In the above model, b3 estimates how the effect of the focal variable F on the outcome variable Y changes as moderator M changes by one unit, holding constant k-3 of the remaining variables W in the model, Hayes and Matthes (2009). According to Hayes and Matthes (2009) the questions about interaction usually focus on the size and significance of b3 in models such as in equation (7-5) above. By rearranging equation (7-5), equation (7-6) can be achieved as shown below, Hayes and Matthes (2009).

$$\boldsymbol{Y = a + (b_1 + b_3 M)F + b_2 M + \sum_{i=4}^{k+1} b_i W_i} \qquad (7\text{-}6)$$

Equation (7-6) shows that the expected difference in Y as a function of differences in F quantify now as (b1+b3M) and it is clearly depends on M. The value of b3 is usually some values other than zero when the coefficients are estimated, Hayes and Matthes (2009).

7.8 Statistical analysis of the moderator variables

The MODPROBE will be used to analyse the effect of the moderator variables on the focal variable 'result demonstrability' (RD). For simplicity the moderator variable has been called as Z.

The dependent, focal, independent and the moderator variables are shown in Table (7-9) below.

Table (7-9): Variables for moderation analysis

Dependent variable	Focal variable	Independent variables	Moderator variables	
IT Adoption	RD	IM	VO	BT
		FC	EO	TB
		SN	AO	TC
			CS	ID
			PR	AG
			ED	DE
			BA	FL
			NE	IB

Where

RD	= Result Demonstrability	IM	= Image
FC	= Facilitating Conditions	SN	= Subjective Norms

Moderator variables

VO	= Voluntariness	EO	= External Orientation
AO	= Achievement Orientation	CS	= Company Slack
PR	= Pro-activity	ED	= Environmental Dynamism
BA	= Business-level Attitude	NE	= Number of Employees
BT	= Business Type	TB	= Time in Business
TC	= Type of Company	ID	= IT department
AG	= Age of manager	DE	=Degree
FL	= Foreign Language	IB	= IT Budget

Now let us apply the above explained approach to our research to identify the moderated variables which helps in improving the derived regression equation.

Note for simplicity let us call the focal variable (RD= X) and the moderator variable equal to Z.

Exploring the effect of voluntariness variable on result demonstrability

The moderator voluntariness is the first moderator to be tested. The MODPROBE output is shown in Table (7-10) below.

Table (7-10): Moderation effect of VO on focal variable RD

Run MATRIX procedure:

SPSS Macro For Probing Interactions In OLS And Logistic Regression

Outcome Variable
Adoption

Focal Predictor Variable
ResultDe

Moderator Variable
Voluntar

Complete Model Regression Summary

R-sq	F	df1	df2	p	n
.3060	18.5930	6.0000	253.0000	.0000	260.0000

==========

R-square increase due to interaction:

R2-chng	F	p
.0258	9.4066	.0024

==========

	b	se	t	p
constant	25.5780	.3683	69.4445	.0000
ImageFAC	1.3416	.4169	3.2182	.0015
Facilita	1.1910	.4105	2.9012	.0040
Subjecti	.8570	.4148	2.0659	.0399
ResultDe	1.2705	.4304	2.9520	.0035
Voluntar	.3251	.4734	.6867	.4929
interact	-1.3038	.4251	-3.0670	.0024

Interact Is defined As:
Result De X Voluntar

==========
Conditional Effect of Focal Predictor at Values of the Moderator Variable

Voluntar	b	se	t	p	LLCI(b)	ULCI(b)
-1.0000	**2.5743**	**.6133**	**4.1972**	**.0000**	**1.3664**	**3.7822**
.0000	**1.2705**	**4304**	**2.9520**	**.0035**	**0.4229**	**2.1181**
1.0000	**-0.0333**	**.5964**	**-0.0559**	**0.9555**	**-1.2079**	**1.1412**

Alpha level used for confidence intervals:.05

Moderator values are the sample mean and plus/minus one SD from the mean

The focal predictor and moderator were mean centered prior to analysis

Explanation of the computer output

Adoption is the dependent variable

Result demonstrability is the focal variable

Voluntariness is the moderator variable.

The interact= interaction of the result demonstrability* voluntariness

The conditional effects of focal variable was automatically calculated by MODPROBE at the moderator's sample mean as well as at ±1 standard deviation above and below the mean.

According to Polat (2010) the MODPROBE approach tests two models to test if the moderation exists between the focal predictor variable and the dependent variable.

The first model includes only focal, moderator and other predictor variables, while the second model includes the interaction between the focal and the moderator variable.

According to Polat (2010) and Jaccard & Turrisi (2003) and Hair et al (2010) if the interaction effect exists then the difference between the two values of R^2 in the two models should be statically significant.

R^2 from the first model is significant $p<0.001$ as shown below.

Complete Model Regression Summary

R-sq	F	df1	df2	p	n
.3060	18.5930	6.0000	253.0000	.0000	260.0000

The increment in R2 value as a result of the interaction is shown below.

R-square increase due to interaction:

R2-chng	F	p
.0258	9.4066	.0024

The value of R^2 chng is also significant at $p<0.05$.

Therefore according to the above explanation the moderation effect exists.

Recall equation (7-5), the adoption equation can be written as follows:

$$\text{Adoption} = 25.5780+1.2705X+0.3251Z-1.3038X*Z \quad (7\text{-}7)$$

The interaction is = -1.3038 as shown in the program output and it is significant at $p<0.01$

Then recall equation (7-6) the adoption can be written as follows:

$$\text{Adoption} = (25.5780+0.3251Z) + (+1.2705-1.3038Z)X \quad (7\text{-}8)$$

If equations (7-7) and (7-8) are compared, the following results can be obtained

b1= the coefficient before moderation =1.2705
b3= the interaction between RD*VO= -1.3038

We chose three values for z from the above program output (or the value = mean ±1 SD)

Let z
z=0, z=1, z=-1

Substitute the above values of Z in equation (7-8), the following equations can be got.
Z=0

Adoption = 25.5780 + 1.2705X (7-9)

Z=1
Adoption= (25.5780+0.3251Z) + (+1.2705-1.3038Z)X (7-10)
Adoption= 25.9031 -0.0333X (7-11)

Z= -1
Adoption= (25.5780+0.3251Z) + (+1.2705-1.3038Z)X (7-12)
Adoption = 25.2529 + 2.5743X (7-13)

Using the MODPROBE output or use the SPSS to get statistical description of X (i.e Result demonstrability) as shown in Table (7-11) below.

Table (7-11): Minimum and Maximum values of Result Demonstrability

Descriptive Statistics

	N	Minimum	Maximum	Mean	SD
Result Demonstrability-factor analysis score	260	-3.80007	1.80678	.0000000	1.00000000
Valid N (listwise)	260				

The values of adoption, Xmin, Xmax at different values of Z are shown in Table (7-12) below

Table (7-12): Effect of voluntariness on focal variable result demonstrability.

Z-values	X min	Adoption	X max	Adoption
-1	-3.80007	15.4703	1.80678	29.9041
0		20.7500		27.8735
1		26.0296		25.8429

The effect of different values of voluntariness (z=-1, 0 and 1) are shown in Figure (7-4) below. The conditional effect of lower and upper limits are also shown in the MODPROBE output. These values are significant for z=-1 and z=0 and insignificant at z=1. Figure (7-4) shows the lower and upper limits of z for z=-1 and z=0.

Both figures show that there is an effect on voluntariness on the focal variable result demonstration.

It is clear from Figure (7-4) that when the moderation occurred to the result demonstrability (focal variable) and this can be explained as follows:

A close look to the MODPROBE output and specifically to the **values of slopes of the focal variable (result demonstrability), the following can be obtained.**

When the moderator variable z=0 the slope of result demonstrability= 1.2705 (red colour shown in Figure (7-4) below).

When the moderator variable z=1 the slope of result demonstrability= -0.0333 (green colour shown in Figure (7-4) below).

When the moderator variable z=-1 the slope of result demonstrability= 2.5743 (black colour shown in Figure (7-4) below).

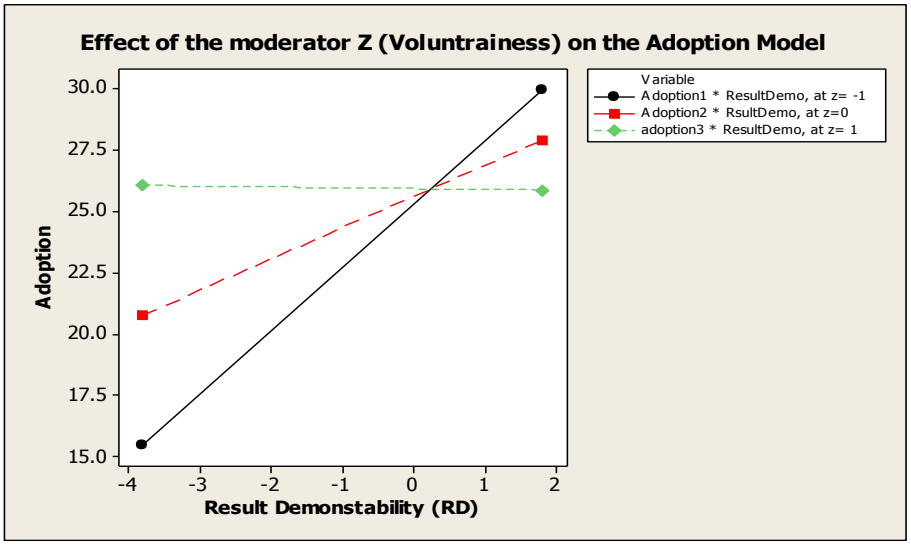


Figure (7-4): Effect of different values of voluntariness on result demonstrability

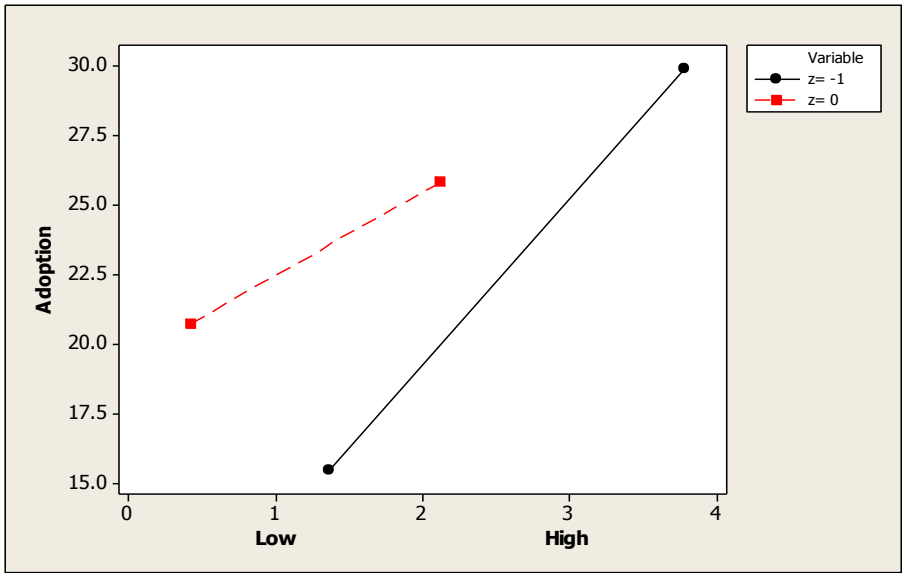


Figure (7-5): Lower and upper limits of voluntariness on result demonstrability

The voluntariness was found to have negative impact on the IT adoption model and this is supported by the literature. This will be explained in detail in the discussion section.

Exploring the effect of external orientation variable on result demonstrability

To investigate the effect of external orientation variable on the demonstration focal variable result demonstration, the investigation should start by assessing the change in R^2, Polat (2010) and Hair (2006). It is clear from Table (7-12) that the change in R^2 is not significant, R^2 chng=0.000, F=0.0142 and p= 0.9053. This means that the external orientation does not have any effect on the result demonstrability. It is also clear from the output that the interaction b= -0.0446 which is not significant (t=-0.1191 and p= 0.9053).

Table (7-13): MODPROBLE output of external orientation as moderator variable

```
Outcome Variable
 Adoption

Focal Predictor Variable
 ResultDe

Moderator Variable
 Ext.Orie-external orientation

Complete Model Regression Summary
      R-sq         F        df1        df2          p          n
     .3239    20.2005     6.0000   253.0000      .0000   260.0000
============================================================================
R-square increase due to interaction:
   R2-chng         F         p
    .0000     .0142     .9053

============================================================================
              b        se         t         p
constant   25.8660     .3904    66.2530     .0000
ImageFAC    1.1816     .4057     2.9122     .0039
Facilita     .8630     .4098     2.1061     .0362
Subjecti     .8870     .4022     2.2056     .0283
ResultDe     .8358     .4392     1.9031     .0582
Ext.Orie    1.7670     .4235     4.1721     .0000
interact    -.0446     .3747     -.1191     .9053

Interact Is defined As:
 ResultDe X       Ext.Orie
============================================================================

Conditional Effect of Focal Predictor at Values of the Moderator Variable
  Ext.Orie     b        se         t       p    LLCI(b)    ULCI(b)
  -1.0000   .8804     .6170    1.4269  .1548     -.3347     2.0955
    .0000   .8358     .4392    1.9031  .0582     -.0291     1.7007
   1.0000   .7911     .5347    1.4797   .1402    -.2618    1.8441

Alpha level used for confidence intervals:
 .05
```

The effect of different values of z (i.e. z=-1, 0, and 1) and for the lower and upper limits of conditional effect on the focal variable are shown in Figures (7-6) and (7-7) below. The lines are parallel which means there is no interaction Polat (2010). A close look to the MODPROBE output and specifically to the **values of slopes of the focal variable (result demonstrability) at different Z values the following observations can be seen.**

When the moderator variable z=0 the slope of result demonstrability= 0.8804 (red colour shown in Figure (7-6) below).

When the moderator variable z=1 the slope of result demonstrability= 0.7911 (green colour shown in Figure (7-6) below).

When the moderator variable z=-1 the slope of result demonstrability= 0.8804 (black colour shown in Figure (7-6) below).

It can be concluded that external orientation is not a moderator variable.

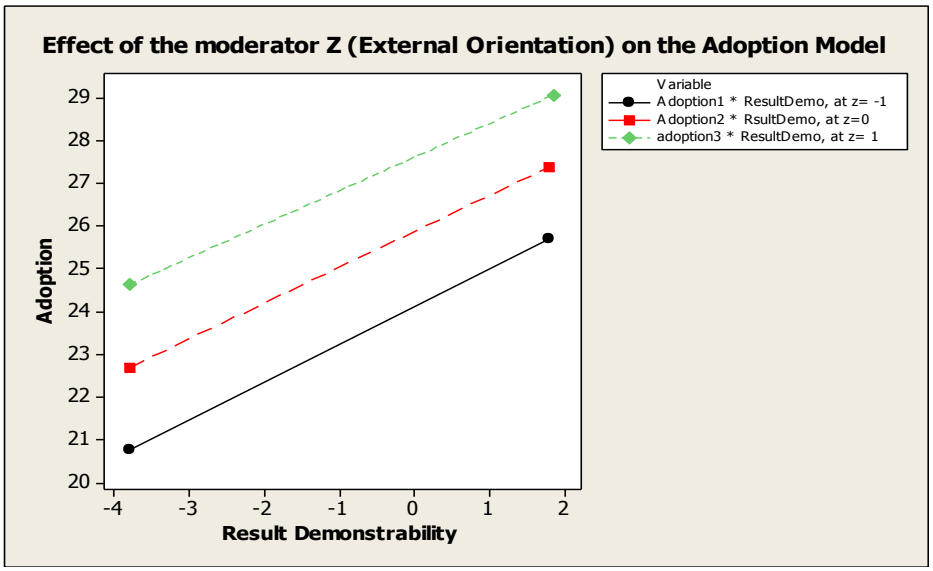


Figure (7-6): Effect of different values of external orientation on result demonstrability

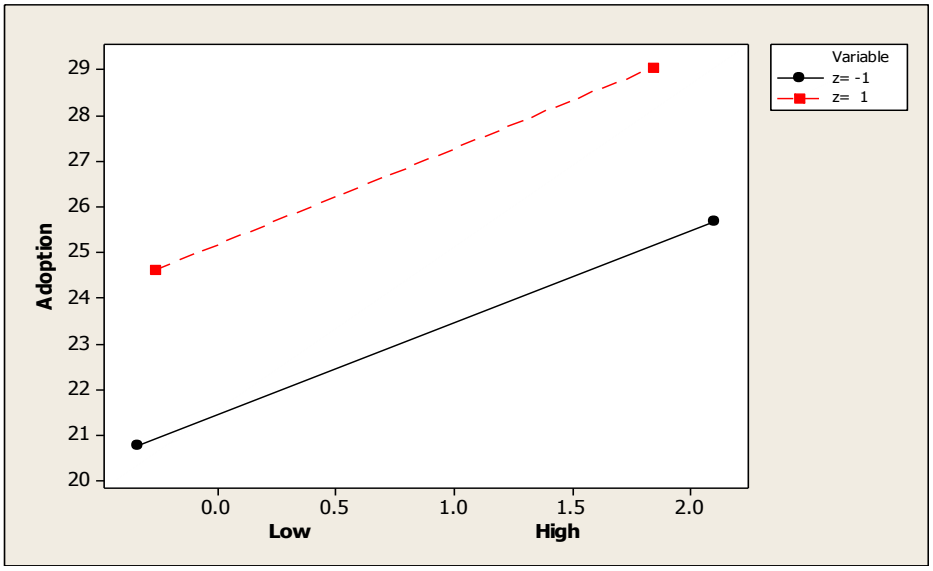


Figure (7-7): Effect of lower and upper limits of external orientation on result demonstrability

Exploring the effect of achievement orientation variable on result demonstrability

Part of the computer output has been selected as shown in Table (7-14) below. The output shows that the achievement orientation is not significant moderator. R^2 chng =0.0042, F=1.4798 and p= 0.2249. The interaction is also not significant b= 0.4920, t=1.2165 and p= 0.2249.

Table (7-14): MODPROBLE output of achievement orientation as moderator variable

Outcome Variable
Adoption

Focal Predictor Variable
ResultDe

Moderator Variable
Achieve.-achievement-orientation

Complete Model Regression Summary

R-sq	F	df1	df2	p	n
.2797	16.3717	6.0000	253.0000	.0000	260.0000

==========

R-square increase due to interaction:

R2-chng	F	p
.0042	1.4798	.2249

==========

	b	se	t	p
constant	25.6711	.3919	65.5053	.0000
ImageFAC	1.3996	.4173	3.3538	.0009
Facilita	1.1363	.4252	2.6726	.0080
Subjecti	1.1450	.4119	2.7795	.0059
ResultDe	1.3563	.4408	3.0770	.0023
Achieve.	-.1006	.4162	-.2418	.8091
interact	.4920	.4045	1.2165	.2249

Exploring the effect of company slack variable on result demonstrability

The MODPROBE output shows that the company slack is not significant moderator variable. The test results shows that R^2 chng= 0.0078, F=0.27673 and p=0.0974. The interaction is also not significant b= 0.7003, t=1.6635 and p=0.0974. This means that company slack has no effect on the adoption of the technology.

Exploring the effect of pro-activity variable on result demonstrability

The MODPROBE output shows that the pro-activity is not significant as a moderator variable. The test results shows that R^2 chng= 0.0089, F=2.0562 and p=0.1537. The interaction is also not significant b= 0.6872, t=1.4339 and p=0.1537. This means that pro-activity factor has no effect on the adoption of the technology.

Exploring the effect of environmental dynamism variable on result demonstrability

Here is again the MODPROBE output shows that the environmental dynamism is not significant as a moderator variable. The test results shows that R^2 chng= 0.0105, F=3.7538 and p=0.0538. The interaction is also not significant b= -0.6924, t=-1.9375 and p=0.0.0538. The conclusion is that environmental dynamism is not a significant moderator variable.

Exploring the effect of business-level attitude toward IT adoption on result demonstrability

This variable is also not significant moderator. The computer output shows that R^2 chng =0.0016, F=0.5516 and p=0.4583. The computer output also shows that the interaction between the moderator and the focal variable is not significant, b=0.2852, t=0.7427 and p=0.4583.

Exploring the effect of number of employees on result demonstrability

The moderator number of employees is significant. The MODPROBE outputs show that the R^2 chng =0.0196, F= 7.0430 and p=0.0085. The interaction between the number of employees and result demonstrability is also statistically significant b=0.0009, t=2.6539 and p=0.0085.

Exploring the effect of business type on result demonstrability

The statistical tests have shown that business type is not a significant moderator variable. The R^2 chng is not significant. R^2 chng=0.0021, F= 7457 and p=0.3887. the results also show that the interaction between moderator and focal variable is not significant. The interaction results show that b=0.3327, t=0.8635 and p=0.3887.

Exploring the effect of time in business on result demonstrability

The MODPROBE tests show that time in business is a significant moderator variable. The results show that R^2 chng= 0.0139, F=5.0791 and p=0.0251. The results also indicate that the interaction between the moderator variable (time in business) and the focal variable (result demonstrability) is significant, b=0.1131, t=2.2537 and p=0.0251.

Exploring the effect of type of organisation on result demonstrability

This moderator which is related to the type of organisation (public, private and foreign) was found to be significant moderator. The statistical results show that R^2 chng= 0.0262, F= 9.5248 and p=0.0023. The interaction was also found to be significant, b= -1.6586, t=-3.0862 and p=0.0023.

Exploring the effect of IT department on result demonstrability

The availability of the IT department in an organisation wasn't found to be a significant moderator variable. The statistical tests show that the R^2 chng= 0.0084, F=3.2081 and p=0.0745. The interaction also was found to be statistically insignificant, b=-1.8527, t=-1.7911 and p=0.0745.

Exploring the effect of age of manager age on result demonstrability

The MODPROBE results show that the age of manager is a significant factor which can moderate the relationship between the adoption and the focal variables. The R^2 chng=0.0180, F=6.4230 and p=0.0119. The interaction between the moderator variable (age of manager) and the focal variable (result demonstrability) was also found to be significant. The interaction results are: b=0.1168, t=2.5344 and p=0.0119.

Exploring the effect of degree on result demonstrability

This moderator variable was also found not significant moderator. The R^2 chng= 0.0021, F=0.7589 and p=0.3845. The interaction test result was also found to be not significant. The interaction test shows b=0.3359, t=0.8712 and p=0.3845.

Exploring the effect of speaking foreign language on result demonstrability

This moderator variable is also found to be not significant. The results show that R^2 chng= 0.0003, F=0.0976 and p=0.7550. The interaction was also found to be not significant, b=-0.4087, t=-0.3124 and p=0.7550.

Exploring the effect of IT budget on result demonstrability

This moderator variable was also found to not significant. The results show that R^2 chng=0.0010, F=0.3547 and p=0.5520. The results also show that the interaction is not significant, b=-0.5120, t=0.5956 and p=0.5520.

7.9 Summary of the tested moderator variables

The summary of all the 16 moderator variables which have been tested to explore their moderation effects are shown in Table (7-15) below. It is clear from this table that only voluntariness, number of employees, time in business, type of organisation and age of manager are found to be statistically significant moderators.

Table (7-15): Summary of the MODPROBE tests

No	Construct		
	IT moderators	**Moderator**	**Not moderator**
1	Voluntariness	Yes	
2	External orientation		No
3	Achievement orientation		No
4	Company slack		No
5	Pro-activity		No
6	Environmental dynamism		No
7	Business –level attitude toward IT adoption		No
	Organisation moderators		
1	Number of employees	Yes	
2	Type of business		No
3	Time in business	Yes	
4	Type of organisation	Yes	
5	Availability of IT department		No
6	Having IT budget		No
	Manager moderators		
1	Age of manager	Yes	
2	Degree		No
3	Speaking foreign language		No

7.10 Results of the hypothesis

The hypotheses results are shown in Table (7-16) below. It is clear from the mentioned table that only voluntariness, number of employees, time in business, type of organisation, and age of the manager were found to be moderator variables. This means that these hypotheses are accepted and reject the other hypotheses.

Table (7-16): Results of the hypothesis

	Hypothesis	Accepted
H_{10}	The voluntariness factor moderates the relationship between the adoption and independent variables in their derived general model	Yes(-)
H_{11}	The external orientation factor moderates the relationship between the adoption and independent variables in their derived general model	No
H_{12}	The achievement factor moderates the relationship between the adoption and independent variables in their derived general model	No
H_{13}	The company slack factor moderates the relationship between the adoption and independent variables in their derived general model	No
H_{14}	The pro-activity factor moderates the relationship between the adoption and independent variables in their derived general model	No
H_{15}	The environmental dynamism factor moderates the relationship between the adoption and independent variables in their derived general model	No
H_{16}	The business-level attitude toward IT adoption factor moderates the relationship between the adoption and independent variables in their derived general model	No
H_{17}	Number of employees moderates the relationship between the adoption and independent variables in their derived general model	Yes(+)
H_{18}	Type of business moderates the relationship between the adoption and independent variables in their derived general model	No
H_{19}	Time in business moderates the relationship between the adoption and independent variables in their derived general model	Yes(+)
H_{20}	Type of company moderates the relationship between the adoption and independent variables in their derived general model	Yes(-)
H_{21}	Having an IT department moderates the relationship between the adoption and independent variables in their derived general model	No
H_{22}	Having a specific IT budget moderates the relationship between the adoption and independent variables in their derived general model	No
H_{23}	Age of manager moderates the relationship between the adoption and independent variables in their derived general model	Yes (+)
H_{24}	Degree moderates the relationship between the adoption and independent variables in their derived general model	No
H_{25}	Speaking of foreign language moderates the relationship between the adoption and independent variables in their derived general model	No

As a summary the effect of each moderator variable on the correlation coefficient (R) of the derived IT adoption model (equation 6-4) is shown in Table (7-17). Table (7-17) shows that the moderator variables effects categorised into three groups: group (A) positive effect, group (B) negative effect and group (C) has no effect. The results show that the number of employees, time in business and age of manager have positive effect on IT adoption model. Group (B) shows that voluntariness and type of

organisation have negative effect on the derived IT model. The other moderator variables were found to have no effect on the derived IT model as shown in group (C). These will be discussed in section (7-11) below.

Table (7-17): Strength and direction of r (effect of moderator variables on IT adoption model)

	Moderator variable	**Effect of moderator on IT adoption model**		
		Group A	**Group B**	**Group C**
		Positive effect on the strength of r (+ Δr)	Negative effect on the strength of r (-Δr)	No effect
	Exploring variables			
1	Voluntariness		- 0.161	
	External orientation			×
	Achievement orientation			×
	Company slack			×
	Pro-activity			×
	Environmental dynamism			×
	Business-level attitude			×
	Organisation moderators			
	Number of employees (size)	+ 0.140		
	Type of business			×
	Time in business	+ 0.118		
	Type of organisation		- 0.159	
	IT department			×
	IT budget			×
	Manager moderators			
	Age of manager	+ 0.134		
	Degree			×
	Speaking foreign language			×

7.11 Discussions

The moderator idea is not a new idea and it has been discussed by many researchers e.g. Zedeck (1971), Sharma et al (1981), Baron and Kenny (1986), Kenny (2009), Jaccard and Turrisi (2003), Polat (2010), Hair et al (2006) and Hayes and Matthes (2009). The idea is to test the effect created by the introduction of another predictor called 'moderator variable' on the simple or multiple regression equations. Hair et al (2006, p. 201) stated that "if an independent-dependent variable relationship is affected by another independent variable, this situation is termed *moderator effect*, which occurs when the moderator variable, a second independent variable, changes the *form* of the relationship between another independent variable and the dependent variable. To assess the change effect of the moderator variable, the assessment should start by assessing the change in R^2 and then the interaction between the moderator and another variable, which called by Hayes and Matthes (2009) as focal variable.

In the area of innovation and adoption the moderator variables have been used by many researchers e.g. Venkatesh et al (2003), Elias et al (2010), Grover (1997), Sun and Zhang (2006) and Lee and Xia (2006). For example Venkatesh et al (2003 used *gender, age, experience and voluntariness of use as moderator variables in their innovation model. While* Elias et al (2010) used age as moderator toward adoption of technology in workplace.

Sun and Zhang (2006) highlighted the point that little attention has been give to the moderator variables. In their review to the literature, the researchers suggested ten moderating variables. Sun and Zhang (2006) identified three types of moderators: organisational factors which include (*voluntariness of IT use, nature of task and profession*). The second type is technology factors which includes (*technology complexity, purpose of using IT (work-oriented vs. entertainment oriented)*; *individual vs. group technologies*. The third category is individual factors which includes (*gender, intellectual capacity, experience, age, cultural background*). In spite that the researchers listed 10 factors considered as moderator variables, however, they not cover all the moderator variables, for example the industry type has not been considered as moderator factor as it was investigated Tan et al (2011).

In this research 16 moderator variables were used to explore their effects on the focal variable, result demonstrability. The moderator variables are: voluntariness, external orientation, achievement, company slack, pro-activity, environmental dynamism, business-level attitude toward IT adoption, number of employees, type of business, time in business, type of organisation, availability of IT department, Having IT budget, age of manager, degree, speaking foreign language.

By using MODPROBE software compatible with SPSS only five moderator variables were found to be significant in moderating the focal variable in the regression equation. These moderator variables: *voluntariness, number of employees, time in business, type of organisation and age of manager*. The impact of the moderator variables on the IT adoption in study is discussed below:

Impact of voluntariness on IT adoption model

Chismar and Wiley-Patton (2002) defined voluntariness 'is the extent to which one perceives the adoption decision as non-mandatory'. While Ventatesh and Davis (2000) defined the voluntariness as 'the extent to which potential adopters perceive the adoption decision to be non-mandatory'.

As far as the voluntariness is concerned, the results of this research indicate that the use of the IT in Libyan construction organisation is not compulsory. This means that they have the freedom in using and not using the system. The descriptive statistic results indicates that 97% of them believe that their clients do not expect them to use the IT also their no governmental or organisational policies to mandate the use of IT compulsory in organisations. The results have shown a negative relationship between IT adoption and voluntariness. This means the perception of more freedom in using the IT the less IT adoption. If the use is compulsory the result might be different. The voluntariness was found to be significant moderator by Venkatesh et al (2003), Kijsanayotin et al (2009) who used ATAUT model derived by Venkatesh et al (2003).

Sun and Zhang (2006) discussed the voluntariness and its effect in the innovation and diffusion models. They indicated that users in the mandatory setting have to comply with the managerial or organisational demands or rules which are not required in the voluntary setting Sun and Zhang (2006). The compliance means a direct influence of subjective norm (SN) on behaviour intention (BI) and usually exists in mandatory context, Sun and Zhang (2006). This means that in mandatory context that the subjective norm (SN) has direct effect on the behaviour intention but not in the voluntary context, Sun and Zhang (2006). Therefore, the voluntariness was considered by the researchers as a moderating variable between the subjective norm (SN) and behaviour intention (BI) and the moderating effect wear off with time, Sun and Zhang (2006). Kautz and Pries-Heje (1996) in their discussion to the diffusion and adoption of the new technology indicated that voluntariness is inversely related to both usage and attitude. This means the more freedom less IT adoption which supports the findings of this study.

Impact of External orientation on IT adoption

Narver and Slater (1990) defined the customer orientation as 'sufficient understanding of one's target buyers to be able to create superior value for them continuously'. While Nystrom et al (2002) indicated that employees within organisations that have better customer orientation enact and perform more effective boundary-spanning roles. It can be said that organisations lack the external orientation means lack of contact with their customers. Nystrom et al (2002) pointed out that a technology not used at a minimal level of capacity can create a financial loss resulting in fewer adoptions in the future.

The external orientation in this study was found not a moderator variable. This could be related to the fact the managers do not feel there is a competitive rivals to challenge. Many managers in the interviews was highlighted an important point which is that some private companies prefer old methods of communications rather than using the modern technologies. O'Regan and Ghobadian, (2005) studied the impact of strategic orientation and environment perceptions in 1000 SMEs in both engineering and electronic companies in the UK. They their findings they classified the companies into two types either prospestors or defenders. The prospectors are more likely to engage in new product development, whereas the defenders are five times more likely to modify an existing product than introduce a newly patent product

Impact of achievement orientation IT adoption

Hyagroup (2006) indicated that achievement is concern for working well for surpassing a standard of excellence. This means work to achieve high results and improves individual and organisational contribution to achieve the assigned goals. The achievement orientation was found not significant in this study. As far as the IT system it is not expected that the Libyan organisations are pioneer in this field.

It can be concluded that the achievement orientation is important factor which promote the success of any organisation. The supportive managers play an important part in achieving the goals of the organisation. In the interview the researcher found that many managers do not support the IT and this could lead to the poor performance of the organisation. Abu-Hassim et al (2011) carried out a research on 398 firms in

Malaysia. They found that the entrepreneurial orientation and innovativeness exert a positive effect on firm business performance and market orientation exhibits a negative effect on firm performance.

Impact of company slack on IT adoption model

Many researchers such as Damanpour (1987), Miller and Friesen (1982) highlighted the importance of slack to organisational innovation and indicated that it should be considered when examining organisational innovation. While Nystrom et al (2002) indicated that the greater slack provides organisation with more resources to adopt innovation, and these innovations may become consistent and continuous. Gong and Yanjuan (2010) indicated that *there are various definitions of slack in the existing literature on slack; all of them reflect the notion of excess resources that both cushion the organization from environmental changes and represent an opportunity for discretionary allocations, such as to innovation activities'*.

Organisation slack was not found to be a moderator in this study. This could be related to the fact that most of the Libyan organisations are working within Libyan boundaries and therefore, they do not be expected to response to the changing surrounding environment.

Impact of Pro-activity on IT adoption model

Unsworth and Sharon (2003, p. 176) discussed the pro-activity and innovation stated that ' *proactivity is about being self-starting and change-oriented in order to enhance personal or organizational effectiveness such as by making improvements to work procedures or using one's initiative to solve problem'*.

This means that the pro-activity in relation to participation in emerging industries, continuous search for market opportunities and experimentation with potential responses to changing environment, Perez-Luno et al (2010), and Miles and Snow (1978). The pro-activity was not found to be a moderator affects the derived IT model. This could be explained that most Libyan organisations doing routine work in their daily activities and most of them do not have the imitative to be pro-active.

Impact of the Environmental dynamism on the IT adoption model

Perez et al (2010), Khandwalla (1977) and Miller and Friesen (1978) agreed in principles in their definition to dynamic environment as one characterised by a high rate of change and newness. While Zhou (2006) indicated that the dynamic environment firms should introduce new products to satisfy the requirements of their customers. Priem et al (1995) carried out a study to find out the rationality in strategic decision processes and firm performance on 101 USA manufacturing firms and they found there is a positive rationality-performance relationship for firms facing dynamic environments, but no relationship between rationality and performance for firms facing stable environments.

The environmental dynamism in this study was not found to be a moderator variables. This could be related to the fact as mentioned earlier that most Libyan organizations are working within the Libyan border and the competition is low within their environmental work.

Impact of Business level attitude toward IT adoption on IT adoption

According to Tornatzky and Klein (1982), Davis et al (1989) and Frambach and Scillewaert (2002) pointed out that the innovation acceptance by individual is based on the beliefs and affects held on innovation, and these beliefs and affects reflected on the attitudes of the individual towards a particular innovation. It can be said that individual attitudes towards to the innovation is a vital factor in adoption of an innovation. Abukhzam and Lee (2010) in their study to the attitude of workforce toward the workforce toward technology adoption indicated that workforce attitude is a very powerful enabler or a barrier towards the adoption of the new technology.

Researchers such as Lakhanpal (1994), Thong and Yap (1995), Hussein (2009), Tan et al (2007) studied the business attitude toward innovation/IT adoption and found that there is a positive relationships between innovation/adoption and the attitude of users. However, Rosen (2005) found that there is non significant relationship between the adoption and attitude toward the IT adoption of the 120 students used in his study in the USA.

This study has found no moderating impact of the business-level-attitude toward the technology on the IT adoption model. This could be related to the fact that most managers in Libyan construction industry do not have a good perception of relative advantage of the technology to their business activities.

Impact of number of employees (org size) on IT adoption

This study found that the organisation size (number of employees) has a positive impact as moderator. The minimum number of employees is 19 and the maximum is 13000 employees (in great river organisation) and the number of organisations (32.7%) is with (1-200 employees) and 25% of the organisations have more than 1000 employees. The increase in the size of the organisation means increase in the availability of resources and opens the opportunities for the organisations employees to have a good chance in using the technology. Studies carried out by Lee and Xia (2006), Yao et al (2002), Damanpour (1992) found a positive relationship between organization size and innovation. Lee and Xia (2006) carried analysis to 21 empirical studies their results show a positive relationship generally existed between the size and IT adoption, the relationship was found to be moderated by five variables: type of IT innovation, type of organisation, stage of adoption, scope of size, and type of size measure. They indicated that the mixed views about the relationship between the size and innovation can be explained by a lack of consideration of moderators.

It can be concluded from the above studies that the majority of the published literature on the relationship between the SME size and innovation/adoption indicate that there is a positive relationship between the two variables.

Impact of Type of Business on IT adoption model

The type of business in this study was not found to be a moderator. This could be related to the fact the selected organisation are working in construction and there is little difference between their IT activities. The finding of this study is supported by the literature Tan et al (2011). Tan et al (2011) carried out a study on 406 managers/owners of manufacturing and services SMEs in Malaysia to find out the effect of type of business as moderator on 7 innovation factors i.e. (relative advantage, compatibility, trilability, observability, security, complexity and cost). The study found that compatibility is the only characteristics moderated by industry type. They interpreted that the ICT is adopted if it is compatible with the job responsibilities and

value systems of the individuals as highlighted by Trornatzky and Klein (1982) and also to the SMEs perception of compatibility with business processes rather than increasing the efficiency and effectiveness. They concluded that industry type is *not a moderator factor*.

Impact of Time in business (organisation age) on IT adoption model

The time in business i.e. (organisation age) was found to have a positive impact on the IT adoption model. This could be related that the old organisations have the experience and the resources and know what the benefits will be gained by adopting the IT systems, compared with new organisations which they do not know what the good and bad for them. Ismail et al (2009) studied the IT adoption in Malaysia food industry and found that there is a positive relationship between the company age and its IT adoption. However, researchers such as Flanagin, (2000) Kimberly and Evanisko (1981); Murphy and Tan, (2003); Nguyen, et al (2003) suggest that the relationship between the organisation age and the innovation adoption is negative. This issue needs to be investigated further.

Impact of type of organisation on the IT adoption

Researchers such as Lee and Xia (2006) and Al-Solbi (2006) found that the type of company i.e (public/private/foreign) has an effect on the adoption. Al-Solbi found that the there is difference in the IT adoption between the public and private organisations in Saudi Arabia. Lee and Xia (2006) have found in their study that the relationship between the adoption and organisation size is moderated by the type of organisation. West and Lu (2009) have compared the private and public sector organisations in using the new technology. They compared the performance of the leading websites companies with US public organisation. In their evaluation they found that private sector outplace the public sector. In this study it has been found that type of company has a negative impact on the IT adoption.

This study has found a negative relationship between the IT adoption and type of company. This could be related to the differences in practices between the public/private and foreign companies. In the interviews it has been highlighted by managers that many private companies prefer the old systems (pen and paper) rather than using the new technology in their daily business activities. It can be concluded

that the private sector is profit oriented sector while the public non-profit oriented sector i.e. service-oriented sector.

Impact of availability of IT department on IT adoption model

Very limited literature has been published on the impact of the availability of an IT department on IT adoption. Al-Solbi (2006) in his study to the e-readiness in Saudi Arabia has found that the availability of IT organisations enables the adoption and diffusion of the technology within these organisations. In this study the availability of the IT department was found to have no impact on the IT adoption. Since the managers highlighted that there is a shortage of the skilled workforce and the technical personnel in Libyan organisations, the availability of the IT doesn't make any difference on the IT adoption.

Impact of IT budget on IT adoption model

The availability of IT budget gives more options to the management to promote the IT and expand the IT projects. Researcher such as Goode and Stevens (2000) studied the adopters and non-adopters of the Internet in 245 SME in Australia and found that there is a positive relationship between Internet based ICT adoption and the cost. This means that the higher the cost the more the adoption and the adopters are younger and have more experience than non-adaptor.

The IT budget was found to be non moderator in this study. This could be related to the fact that the Libyan organisations are very familiar with the technology and spend money on IT projects. In the interviews managers highlighted that their equipment are out of date and need to be replaced by new versions of technologies.

Impact of the manager age on IT adoption model

Age of the owner/manager was found to have positive impact on the innovation and adoption of the technology. Hunter and Kemp (2004), Mharmah (2003), Daly and Kitchell (1995), Taylor (1975), Hambrick and Mason (1984), Burke and Light (1981) and Hung and Lo (2010) identified that there is a negative relationship between manager's age and innovation adoption. For example, Hunter and Kemp (2004) found that younger ages of investors are more open and had positive attitudes toward adopting e-commerce. This is expected since the young people who used the new

technologies in their childhood are more familiar with it than the older people. Burke and Light (1981) went further to indicate that certain learning abilities such as memory to decline with age, while Taylor (1975) highlighted important point which is the fact that the older managers are less able to evaluate new ideas quickly and integrate them effectively in decision making. Sun and Zhang (2006) in their review to the available models published in the field of innovation and adoptions found that age as a moderator has a weaker impact on the relationship between the subjective norm-perceived usefulness, subjective norm-behavioural intention, and perceived ease of use-behavioural intention for younger users. In the same way they that found age as moderator has stronger impact on the perceived usefulness-behavioural intention for younger users.

The positive relationship between age and IT adoption could be related to the fact that the majority of the survey managers in this study have old ages. The descriptive statistic shows that the majority of the manager are >40 years old (38.5%), followed by(36-40years) 25.4% , (31-35years)23.1% and only 13.1% are between 21-30 years. This means that the percentage of the young people is low and this could have an impact on the statistical test.

Impact of Degree on IT adoption model

The degree in this study has found to have no impact on the IT adoption. This could be related to the willingness of the manager and his/her perception in the benefits gained from adopting the IT system and it doesn't relate to the degree. In the interviews many managers highlighted the point that there are managers who carry higher degree (MSc or PhD) but they do not support the use of the IT systems in Libyan organisation. Hung and Lo (2010) carried out a study in Taiwan aimed to study the relationship among business performance, CEO background and CEO ownership. They found that there is a negative relationship between business performance and degree of the managers/CEO. They found that managers with higher degree achieve worse performance than managers with lower degree. They also found that foreign degree is insignificant to performance.

Impact of speaking foreign language on IT adoption

Paul (2006), Global Reach (2004) and by Al-Solbi (2006) pointed out that the language is an obstacle in the Arab world preventing them from using the new technology. Speaking foreign language was found not significant moderator. This could be related to the fact that most managers are university graduates (they can speak foreign language) and also could be related to the nature of business they carry out (technical rather linguistic) and therefore the language is vital moderator here.

7.12 Conclusions

The main conclusions from this chapter are as follows:

1. The reliability tests of the moderator variables were shown having acceptaple values of Cronbach's Alpha. This means that the questions which were used in this research are reliable and can achieve satisfied results.

2. ANOVA tests of the moderator variables have shown that the majority of these variables have shown statistical differences between the questions means. This colud be related to the nature of the moderator variables.Some could be related to the background and profiles of the managers and others are related to organisation profiles.

3. The effect of 16 moderating variables was explored to find their effect on the derived IT adoption model. These variables related to the innovation characteristics such as (voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, and business –level attitude toward IT adoption); organisational characteristics such as (number of employees –i.e. size of organisation, type of business, time in business, type of organisation, availability of IT department and having IT budget); managerial characteristics such as (age of manager, degree, and speaking foreign language).

4. MODPROBE software developed by Hayes and Matthes (2009) which is compatible with the SPSS software was used to assess the effect of each moderator variable on the derived IT adoption model. The effect usually

assessed by assessing the change in R^2 and also the interaction resulted from the effect of the moderator, Hair et al (2006), Polat (2010) and Hayes and Math (2009).

5. The statistical tests reveal that voluntariness has a negative impact on the derived IT adoption model. This result is expected since the managers in Libyan organisations indicated that their use of the ICT system is voluntary. Over 97% in Libyan organisation do not think that their client expect to use the IT systems. This will have negative impact on the performance of the organisations and their goals. Sun and Zhang (2006) highlighted the point that users in the mandatory setting have to comply with managerial demands or rules which are not the case in the voluntary setting. Kautz and Pries-Heje (1996) also found out that the diffusion and adoption of a new technology is inversely related to the usage and attitude. This means more freedom in the use of the technology the less adoption and this could have a negative impact on the organisation's performance which is required to achieve their business goals.

6. Size of organisation (number of employees) was found to have positive impact on the derived IT adoption model and this supported by studies carried out by Lee and Xia (2006), Yao et al (2002), Damanpour (1992) found a positive relationship between organization size and innovation. This could be related to fact that larger organizations have more resources and also have larger scale of goals and objectives.

7. Time in business was found to have a positive impact on the derived IT adoption model and this is supported by Ismail et al (2009) study findings of IT adoption in Malaysia food industry who found that there is a positive relationship between the company age and its IT adoption. This could be justified that the older organisations have the experience and perception what the new technology could add to improve their business activities compared with the new organisations which lack the experience in this field.

8. Type of company (public/private/foreign) was found to have a negative impact on the IT adoption model. This could be related to the differences in their policies and practices West and Lu (2006) and Lee and Xia (2006). The managers in Libyan organisations highlighted an important point that many private sector companies do not like the new technology and prefer the old methods of using (pencil and paper method) in their business activities. They indicated this is a problem which delays the work and wasting time. Usually the public organisations are non-profit organisations compared with the private sector organisations which are profit oriented organisations.

9. Age of the manager was found to have positive impact on the IT adoption model. This comes in contrary to the literature, e.g Hunter and Kemp(2004), Mharmah (2003). This positive impact could be related to the fact that the survey also found the majority of the manager are >40 years old (38.5%), followed by(36-40years) 25.4% , (31-35years)23.1% and only 13.1% are between 21-30 years. This means that the young people have little influence in the managerial matters. This point needs to be investigated further.

10. The other moderators such as (external orientation, achievement orientation, company slack, pro-activity environmental dynamism, business attitude toward IT, type of business, IT department, IT budget, degree and speaking foreign language were found to have no impact on the derived IT adoption model. Type of business was found by Tan et al (2011) to have no impact on the adoption of innovation in Malaysian SMEs which agrees with this study finding. While Hung and Lo (2010) found negative relationship between degree and innovation in Taiwanian organisations. The Libyan organisations were under pressure from the united nation embargo in the past 10 years and this could have a negative impact on their performance and understanding to the technology.

Chapter Eight: Conclusions and Recommendations

1- Introduction

The main aim of this research was to investigate the IT adoption in Libyan construction sector. Two methodologies (quantitative and qualitative methodologies) were devised to investigate this important issue. In order to achieve this aim, four main objectives were set as follows:

The first objective was to review, analyse and synthesise the current available literature (theories and models) related to the IT adoption and innovation in this field. This has helped to construct the conceptual model for this research.

Based on the first objective, the second objective was to build up a conceptual model for this research to explore the relationship between the constructs' variables of the constructed model.

The third objective was to devise two methodologies (quantitative and qualitative methodologies to explore the following issues:

- To investigate the profiles of the Libyan construction organisations and also the profiles of the managers/engineers who run these organisations
- To investigate the internal barriers faced by the Libyan construction organisations in their utilisation of the IT in their daily activities
- To investigate the external barriers faced by the Libyan construction organisations in their utilisation of the IT in their daily activities.
- To investigate the relationships between IT adoption and IT innovation factors such as relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms.
- To explore the effect of innovation moderator variables such as (voluntariness, external orientation, achievement orientation, company slack, pro-activity, external dynamism, business-level attitude toward IT adoption) on IT adoption.
- To explore the effect of organisation moderator variables such as (organisation size -number of employees, type of business, time in business, Type of company, availability of IT department and having an IT budget) on IT adoption

- To explore the effect of managers moderator variables such as (age of manager, degree, and ability of speaking foreign language) on IT adoption

The fourth objective was to draw useful conclusions to benefits of the Libyan construction organisations.

Data analysis was carried out by using SPSS software and also by using MDPROBE macro presented by Hayes and Matthes (2009) to investigate the effect of the moderator variables on the IT adoption. The findings of this study are shown below.

8.2 The main findings of this research

Very interesting findings were revealed in this research and can be summarised below:

- *Organisations profile*: The results have shown that the minimum number of employees are 19 and the maximum is 13000 employees (in great river organisation), 65% of the surveyed organisations have number of employees ranging between 1 and 600, and 25% have number of employees >1000 employees. The survey has shown that 51.5% of the surveyed organisations have their HQ located in the west of the country ((in Tripoli, Alzawyah and Tajorah) followed by 21.2% (in Sert and Mesrata), 13.5% (Sebha and Jefrah) and 13.8in (Benghazi) in the north, south and east of the country respectively. The survey also shows that 42.5% were established between (1-10years), 37.7% established between (11-20) years and 15.4% established between (21-30) years). The survey also shows that the majority of the surveyed organisations are engaged in contracting (56.5%) and rest engage in investment, construction, maintenance and consulting engineering. The survey also found that 50.8% of the surveyed organisations are private and 29.2% and 20% are public and foreign respectively. The survey has shown that 80.4% have an IT department and 71.5% have an IT budget.

- *Managers' profile*: the results reveal that 36.9% are managers, 27.3% engineers, 20.4% chief executives/senior managers and only 7.7% for each of the architect and the financial officer. The survey has also shown that the majority of the managers are Libyan national (77.7%), followed by the Arab (13.6%) and foreigners (8.8%). The survey also found the majority of the manager are >40

years old (38.5%), followed by(36-40years) 25.4% , (31-35years) 23.1% and only 13.1% are between 21-30 years. This means that the young people have little influence in the managerial matters. The survey also shown that 87.3% of the surveyed managers are male. The survey also has revealed that the majority of the managers have master degree (39.6%). The second group is the BSc (25.4%) followed by PhD (19.2%) and Diploma (15.8%). This is an interesting finding because most of the managers are highly qualified. The area of qualifications indicates that the majority (59.2%) of the managers have civil engineering background followed by the project management area (20.4%). This is expected since this study is related to the Libyan construction organisations only. The survey also shows that most managers graduated from Libyan universities (56.5%) followed by (17.3%) from European countries such as UK and France and Russia, and 14.2% from Arab countries such as Egypt, Iraq and Jordan, 7.7% graduated from US and Canada and 4.2% graduated from far east such as Indonesia, Malaysia and China. As far as the ability of the managers of speaking foreign language the survey shows that 85.7%) are able to speak foreign language.

- As far as the *internal barriers* concern, this study has found in the interviews with the managers very interesting issues. These issues were very important issues facing the construction organisations in Libya. These issues are related to shortage in national skilled workforce in the ICT field, Lack of training courses internally and externally, Lack of availability of foreign skilled workforce in the ICT field, Security of the information on the internet, lack of Libyan national engineers who have experience in engineering software related to the engineering sciences such analysis and design and modelling, many managers indicated that some managers have conservative approach toward the adoption and spreading the ICT systems, non-availability of the communication technologies for site engineers, lack of motivational rewards for the employees to encourage them to use the new technology, limited authorities given to the junior managers. More power should be given to the middle managers to take decision related to the ICT systems in their offices. This means the centralization has a negative impact on the IT adoption decisions. Other obstacles were that many private companies prefer the old paperwork, speed of the Internet network is low (and sometimes cutoff completely). This makes very difficult for the staff to send /receive documents via

the Internet. Another important issue was found by this study that there is no appropriate plan to put the suitable person in the right position. This is related to the fact that the main office sometimes imposes people who are not efficient and do not support ICT adoption. However, there are attempts to improve the situation. The study also found that the old managers do not support the IT adoption and use and those people should be replaced by people who have an interest in encouraging the use of the technology.

- As far as the *external obstacles* this research has found that there were many important issues which could prevent the innovation in Libyan construction organisations. These issues are related to: poor communication between the main office and the branches especially in desert areas where the network coverage is very weak, poor post office services, one manager of foreign company (Turkey) indicated that '*the external barriers are related to poor banking system, and low awareness and education of the public on using the new technology. Internet security is also an important factor in this regard. There are other problems related to the high imposed taxes on foreign companies and many problems related to high money renting of land to build foreign companies near the construction sites. There is another problem related to the delay in the schedule of payment for the completed works and also visa problems'*. Other external barriers were also found such as: lack of government support, and lack of government regulations on how to use the technology.

- The IT adoption was found to have positive relationships with all the 9 independent variables studied in the IT model. However, the independent variable result demonstrability was found to have the highest correlation coefficient (R=0.402) and the relative advantage has the lowest correlation coefficient (R=0.265). This means that the organisations are happy with their achievement in using the IT in their activities and proudly can demonstrate their achievements to others. A stepwise multiple regression between the IT adoption and the independent variables revealed that the IT adoption depends on the result demonstrability, subjective norms, image and facilitating conditions. The quantitative results here support the qualitative (interviews) findings. In the

qualitative approach most managers indicated that they are proud in their use of the IT in their daily activities and with their peer in the supply chain. They also indicated that their image in using the technology have impact on their reputation within their working environment and within the external environment. Nevertheless, they also indicated that they have most of the required resources to run their IT business activities. However, they indicated in the interviews that they face some barriers such as shortage of skilled workforce etc, which were summarised above.

- As far as the moderator variables impact on the IT adoption interesting results were revealed that from 16 moderator variables used in this model only five moderator variables were found to have impact on the IT adoption. These variables are: voluntariness, number of employees, time in business, type of company (i.e public, private and foreign), and age of manager. The effect of the voluntariness and organisation type was found to be negative while the impact of the others was found to be positive.

- Voluntariness was found to have a negative impact on the IT adoption model. This could be related to fact that the use of the IT in Libyan organisations is voluntary. Therefore, it can be said that the setting of the use either voluntariness or mandatory has an important impact on the IT adoption and use.

- While the effect of the organisation type could be related to the differences in practices between the public, private and foreign companies. This issue needs to be investigated in more details.

- Size of organisation (number of employees) was found to have positive impact on the IT adoption in this study. This could be related to availability of the required resources and to the goals and policies of the big organizations compared with the small ones.

- As far as the organisation age impact on innovation, the results revealed that the organisation age has a positive impact on IT innovation in Libyan construction

organisation. However, researchers such as Flanagin, 2000; Kimberly and Evanisko, 1981; Murphy and Tan, 2003; Nguyen, et al (2003) suggest that the relationship between the organisation age and the innovation adoption is negative, i.e. the younger organisations are more willing to adopt technology than the older ones. However, Ismail et al (2009) studied the IT adoption in Malaysia food industry found a positive relationship between the company age and its IT adoption. The common sense is that the older organisations have the experience and perceptions of the technology better than the new organisations. It can be said the relationship is not conclusive and needs to be studied in more details.

- The manager age was found to have a positive effect on the adoption. This relationship is also not conclusive since different researchers gave different results of the relationship between manager age and IT adoption. For example, Hung and Lo (2010) in their study of the ICT applications in Taiwan industry found that the age of managers is negatively related to the ICT usage in Taiwan industry. They indicated that the elder managers achieve worse performance in ICT use compared to the younger managers. On the other hand, Song and Ma (2010) studied 91 Chinese companies and found that the impact of age and educational level on technological innovation is not significant. Another study carried out by Awamleh (1994) on 293 managers in civil service in Jordanian organisations found that there is a negative yet weak relationship between innovation and age, organisational level, and length of service. The age of the manager needs to be investigated in more details. The results of this study found that the minimum age was 24 years and the maximum age is 58 years and the mean and standard deviation are 39.05 and 7.560 respectively. This means that the majority of the managers have older age and because of this the obtained results can be explained.

- The other moderators such as (external orientation, achievement orientation, company slack, pro-activity environmental dynamism, business attitude toward IT, type of business, IT department, IT budget, degree and speaking foreign language were found to have no impact on the derived IT adoption model.

8.3 Contribution of this research to the stage of knowledge

From the available literature in the field of IT adoption it can be concluded that there is no universal theory or model can claim its uniqueness in explaining and interpretation of the IT systems adoption in organisations. The reasons are related to complexity of the subject as there are many factors related to the technology itself, managerial factors and people related factors. Some of the available theories and models were derived to fit individuals rather than organisations. Business organisations also differ in their understanding to the benefits gain from the technology. This is related to differences in their daily activities.

Therefore this research has been designed to concentrate on the construction organisations only. Two methodologies were devised to achieve the objectives of this research. The findings of this research are very useful to the construction organisations and contributed positively to the state of knowledge in this field. This research studied two types of important variables specified in the literature affecting the innovation and IT adoption in construction industry.

The first type of these variables were the innovation variables which have direct effect on decision makers persuasion to adopt IT adoption in their business activities such as : relative advantage, compatibility, image, ease of use, result demonstrability, visibility, trialability, facilitating conditions and subjective norms. The research has found that these variables have positive and direct impact on IT adoption. The findings of both the interviews and the questionnaire support each other in this regard. This is very important findings which will very useful for any construction industry.

The second set of variables was the moderator variables. The moderator variables have been given very little attention in the literature. Sun and Zhang (2006) reviewed the literature and found out that little attention has been given to the moderator variables. This study has used 16 moderator variables. These moderator variables were: voluntariness, external orientation, achievement orientation, company slack, pro-activity, environmental dynamism, business-level attitude, number of employees (size), type of business, time in business, type of organisation, IT department, IT budget, age of manager, degree and speaking foreign language.

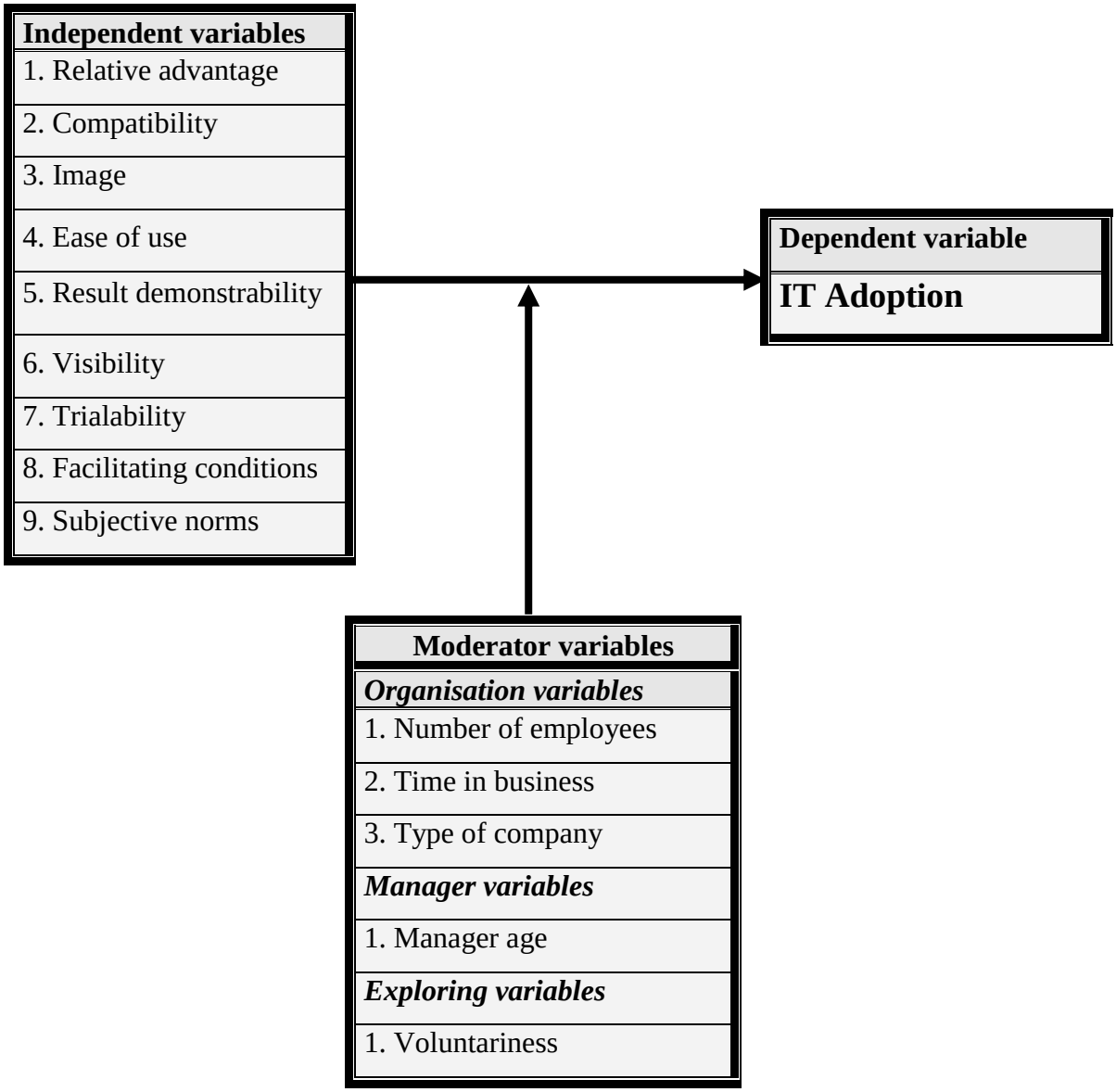
The impact of these variables on the derived general innovation model was studied carefully.

The results of this study are shown below.

	Moderator variable	**Effect of moderator on IT adoption model**		
		Group A	**Group B**	**Group C**
		Positive effect on the strength of r **(+ Δr)**	Negative effect on the strength of r **(-Δr)**	**No effect**
	Exploring variables			
1	Voluntariness		- 0.161	
2	External orientation			×
3	Achievement orientation			×
4	Company slack			×
5	Pro-activity			×
6	Environmental dynamism			×
7	Business-level attitude			×
	Organisation moderators			
8	Number of employees (size)	+ 0.140		
9	Type of business			×
10	Time in business	+ 0.118		
11	Type of organisation		- 0.159	
12	IT department			×
13	IT budget			×
	Manager moderators			
14	Age of manager	+ 0.134		
15	Degree			×
16	Speaking foreign language			×

Only five of sixteen moderators were found to have impact on the derived innovation general model in this study. This is very useful findings to IT researchers in the field of IT in Libya and in the world. This is a positive contribution of this study to the field of innovation and IT adoption.

As a result of these findings the proposed model will become as shown below.



Research Model

8.4 The implications of the findings on the current IT practices in Libyan organisation

The recommendations for the Libyan government and Libyan organisations are as follows:

- The government and the organisations should promote the IT in their organisations and usage should be compulsory rather than voluntary. This

could help in promoting the IT adoption and also help the organisations to be competitive with their rival's organisations.

- More incentive schemes and motivations need to be provided by the organisations to promote the IT
- Younger managers should be promoted to take responsibilities in decisions making related to the IT business.
- The government and the organisations should promote the training courses in the field of IT.
- The government should introduce code of practice to regulate the use of the IT and also to protect the rights of both sellers and buyers.
- Grants and loans schemes should be used to promote the private sector in the field of the IT
- The banking system should be modernised to attract foreign investment.

8.5 Limitations of the research

In order to achieve useful conclusions from this research limitations have been set for this research. This means that the research should focus on a specific area to explore in depth the issue under investigation. The main limitations of this research are as follows:

The research was only focused on the construction sector in Libya. The selection of the construction sector is related to the fact that the construction industry is very important sector in any economy of any country, and therefore, studying IT innovation in the construction industry strengthening the competitiveness and growth of the organisations, Becheikh et al (2006) and Bala Subrahmanya et al (2009, 2010).

The research is also concentrated on the constriction sector because this sector is under researched as highlighted by Grifa (2006). Therefore, this research was designed to be focused on the construction industry.

8.6 Recommendations for further studies

Since the IT innovation is the subject of today research, the researcher suggests the following research to be carried out:

The banking system is very weak and that affects the foreign investment in the country. It needs to be in the 21st century in transaction and buying and selling activities to support the business.

A study should be carried out to find out the impact of the poor post offices impact on Libyan businesses.

A comparative study needs to be carried to benchmark the Libyan organisation utilisation of IT with other countries such as South Africa, Egypt, Saudi Arabia and United Arab Emirate. This could help in understating the barriers and difficulties facing the Arab countries which have same cultural factors.

A study should be carried out to investigate the role of the government in the innovation and adoption of the new technology. The study should include the impact of the financial, political and governmental aspects in this matter.

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Appendix A- Barriers to the IT adoption in different countries

Appendix A: List of the main barriers which were found in the literature related to the adoption and diffusion of new technologies.

No	Barrier	Reference	Study	Country
	External Barriers			
	Government regulations	Al-Solbi (2005),	Evaluating and Improving E-Readiness Assessment Methods and Tools. PhD thesis School of Computing Sciences, University of East Anglia, UK.	Saudi Arabia
		Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Economic factor, political-legal and government factor, procedural factor and currency factor.	Al-Hyari (2009)	Exploring barriers and Internationalisation of Manufacturing Activities of SMEs in Jordan	Jordan
		Aubert, Jean-Eric (2004)	Promoting Innovation in developing countries: A conceptual framework. World Bank Institute	World Bank Institute
	Legislation, regulations, norms, standards	Levratto (2009)	The French Programme for financing innovation in SMEs.	France
	Lack of students studying engineering and sciences	Tiwari and Buse (2007)	Barriers to Innovation in SMEs: Can the Internationalization of R&D Mitigate their effects?.	Germany
	Lack of intellectual property rights	Baldwin and Gellatly (2004)	Innovation Strategies and Performance in Small firms	Canada
	Lack of national strategies	Aubert, Jean-Eric (2004)	Promoting Innovation in developing countries: A conceptual framework. World Bank Institute	World Bank Institute
	Lack of customer responsiveness to new products and processes	Levratto, N. (2009)	The French Programme for financing innovation in SMEs.	France
	Consumer preference	Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Marco economy	Al-Solbi (2005),	Evaluating and Improving E-Readiness Assessment Methods and Tools. PhD thesis School of Computing Sciences, University of	Saudi Arabia

			East Anglia, UK.	
		Katila, R., and S. Shane (2005).	"When Does Lack of Resources Make New Firms Innovative?"	MIT-USA
		Gordillo, M., and P. Herrmann (2005).	"Adoption of New Technologies in the Face of Economic Crises:	Ecuador
	Uncertainty of economy, government policy, and global competition	Antonia et al (2009)	Barriers to innovation among Spanish manufacturing SMEs	Spain
	Lack of government grants to innovation projects	Aubert, Jean-Eric (2004)	Promoting Innovation in developing countries: A conceptual framework. World Bank Institute	World Bank Institute
	Inadequate funding, risk avoidance, Siloing-i.e to protect business boundaries and don not like to expand the business boundaries, time commitments, and incorrect measures.	Andrews (2006)	Five barriers to innovation: Key questions and answers.	IBM –Technology report
	Lack of financial support	Tiwari and Buse (2007)	Barriers to Innovation in SMEs: Can the Internationalization of R&D Mitigate their effects?.	Germany
	Internal barriers-technology characteristic			
	Complexity and difficulty to use the software, and frustration about the speed, reliability and internet accessibility. Also there were no tangible rewards from the management to the users.	Walker and Peasupap (2004**)**	Factors affecting ICT Diffusion in Australian Constructions Organisations-The Storey from the Big End	Australia
	Complexity of the ICT system	**Garson (2006)**	Diffusion Theory	USA
		Walker and Peasupap (2004))	Factors affecting ICT Diffusion in Australian Constructions Organisations-The Storey from the Big End	Australia
		Rogers (1995	Diffusion of Innovations	Australia
		Al-Qirim (2006, 2007)	Personas of E-Commerce Adoption in Small Businesses in New Zealand. Personas of E-Commerce Adoption in Small Businesses: Case from New Zealand	New Zealand
		Looi (2004)	A model of factors influencing electronic commerce adoption among SMEs in Brunei Darussalam	Brunei Darussalam
		Garson (2006)	Diffusion Theory	USA

	Compatibility	Rogers (1995)	Diffusion of Innovations	Australia
		Garson (2006)	Diffusion Theory	USA
		Al-Qirmi (2006, 2007)	Personas of E-Commerce Adoption in Small Businesses in New Zealand. Personas of E-Commerce Adoption in Small Businesses: Case from New Zealand	New Zealand
		Looi (2004)	A model of factors influencing electronic commerce adoption among SMEs in Brunei Darussalam	Brunei Darussalam
	Security	Muller-Seitz et al (2009)	Customer acceptance of RFID technology: Evidence from the German electronic retail sector	Germany
	Security –issue and internet fraud	Stockdale and Standing (2006)	A classification model to support SME e-commerce adoption initiatives	Australia
	Internal- managerial issues			
	Weak management commitment and leadership, resistance of employees,	Antonia et al (2009)	Barriers to innovation among Spanish manufacturing SMEs	Spain
	Management level/organisational decision- making obstacles	Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Bureaucratic management	Tiwari and Buse (2007)	Barriers to Innovation in SMEs: Can the Internationalization of R&D Mitigate their effects?.	Germany
	The authors found that gender also play part in e-commerce adoption. They found that female is not in favourite of adopting EC compared to their counterpart male gender in SMEs.	MacGregor and Vrazalic (2006)	E-commerce Adoption Barriers in Small Business and the differential effects of Gender.	Sweden
	Younger ages of investors are more open and had positive attitudes toward adopting e-commerce	Hunter and Kemp (2004)	The personality of e-commerce investors.	New Zealand
	The author indicated that the owner-manager locus control, and the constraints of resources affect the	Hansemark(1998)	The effects of an entrepreneurship programme on need for achievement and locus of control	UK

	behaviour of the SMEs. The effect of the owner/manager on the adoption of e-commerce in the SMEs has also been highlighted by Matlay and Addis (2003)	 Matlay and Addis (2003)	of reinforcement. Adoption of ICT and e-commerce in small business: an HEI-based consultancy perspective .	 UK
	The author indicated that the owner-manager locus control, and the constraints of resources affect the behaviour of the SMEs. The effect of the owner/manager on the adoption of e-commerce in the SMEs has also been highlighted by Matlay and Addis (2003)	Hansemark(1998) Matlay and Addis (2003)	The effects of an entrepreneurship programme on need for achievement and locus of control of reinforcement Adoption of ICT and e-commerce in small business: an HEI-based consultancy perspective .	UK UK
	Resistance of change in the firm (rigid organisation	Levratto, N. (2009)	The French Programme for financing innovation in SMEs.	France
	Educational background of the owners/managers is a key factor in IT adoption.	Fichman and Kemere (1997)	The Assimilation of software process innovations: an organisational learning perspective.	USA-Pennsylvania
	Bad information management	Oak (2007)	A review on barriers to implementing health informatics in developing countries	Fiji Islands
	Lack of knowledge on how to manage the innovation	Tiwari and Buse (2007)	Barriers to Innovation in SMEs: Can the Internationalization of R&D Mitigate their effects?.	Germany

		Mohnen and Rosa (1999):	Barriers to Innovation in Service Industries in Canada.	Canada
	Lack of information on technology	Levratto (2009)	The French Programme for financing innovation in SMEs.	France
	Lack of information on markets	Levratto (2009)	The French Programme for financing innovation in SMEs.	France
		Zwick, T. (202).	"Employee Resistance against Innovations,"	Germany
	Lack of cooperation with business partners/supply chain	Tiwari and Buse (2007)	Barriers to Innovation in SMEs: Can the Internationalization of R&D Mitigate their effects?.	Germany
		SusChem (2009)	**BIOCHEM** Supporting European SMEs to innovate in the sustainable bio based products market	Europe
	Lack of awareness on the benefits of innovation	SusChem (2009)	**BIOCHEM** Supporting European SMEs to innovate in the sustainable bio based products market	Europe
	Excessive perceived of economic risk	Levratto, N. (2009)	The French Programme for financing innovation in SMEs.	France
	Lack of cooperation with business partners and supply chain	Tiwari and Buse (2007)	Barriers to Innovation in SMEs: Can the Internationalization of R&D Mitigate their effects?.	Germany
		SusChem (2009)	**BIOCHEM** Supporting European SMEs to innovate in the sustainable bio based products market	Europe
		Hewitt-Dundas, N. (2006).	"Resource and Capability Constraints to Innovation in Small and Large Plants,"	Ireland
	Laboratory to field obstacles	Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Style of management	Weatley (1999)	Leadership and the new science. Learning about Organisations from an Orderly Universe	USA
	Identified social and technical barriers (such lack of skills,	Lawson et al (2003)	Factors affecting adoption of electronic	Australia

	knowledge and poorly trained people).		commerce technology by SMEs : an Australian Study.	
	Low awareness and education level	Sim et al (2008)	Barriers to the adoption of e-commerce among small and medium sized enterprises: A study on the non-adopters in Malaysia.	Malaysia
	Style of managers, gender, lack of commitment	Mostafa (2005).	Factors affecting organisational creativity and innovativeness in Egyptian business organisations: an empirical investigation.	Egypt
	Attitudes of the management (managers) toward the ICT, qualification and experiences of managers. Cost of the hardware software, Power supply, fear of virus attacks, high obsolescence of hardware/software, inadequate ICT content of construction education, high cost of employing computer professionals, lack appreciation of ICT by firm's management, security/privacy fears, low return on investment, fear of mass losses in industry	Oladapo (2007	An investigation into the use of ICT in the Nigerian construction industry.	Nigeria
	Other factors			
	Low levels of educational attainment	Aubert, Jean-Eric (2004)	Promoting Innovation in developing countries: A conceptual framework. World Bank Institute	World Bank Institute
	Brain drain	Aubert, Jean-Eric (2004)	Promoting Innovation in developing countries: A conceptual framework. World Bank Institute	World Bank Institute
	Untrained people	Oak (2007)	A review on barriers to implementing health informatics in developing countries	Fiji Islands
	Lack of skilled personnel	Levratto, N. (2009)	The French Programme for financing innovation in SMEs.	France
	Human interrelationships obstacles	Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Culture and socio-ecological factors	Oak (2007)	A review on barriers to implementing health informatics in developing countries	Fiji Islands
	Cultural factor	McCoy et al (2005)	An examination of the technology acceptance model in Uruguay and the US: A focus on culture	USA and Uruguay

	Cultural factor-such as language & religion Al-Solbi also highlighted the following barriers to the e-readiness in Saudi Arabia organisations: Non availability of code of practice. Non-availability of home addresses Security of the information on the internet Lack of legislations Lack of skilled workforce	Al-Solbi (2006)	Evaluating and Improving E-Readiness Assessment Methods and Tools. PhD thesis School of Computing Sciences, University of East Anglia, UK.	Saudi Arabia
	Cultural factor-such as language & religion	Elbeltagi (2007)	E-commerce and globalisation: an exploratory study of Egypt.	Egypt
	Cultural factor-purchasing behaviour and public awareness, poor banking system	Afzal (2008)	.	Iran
	Innovation costs too high	Levratto, N. (2009)	The French Programme for financing innovation in SMEs.	France
	Lack of appropriate source of finance	Levratto, N. (2009)	The French Programme for financing innovation in SMEs.	France
		Drury (2005)	The eHealth agenda for developing countries	Kenya
	Economy-cost return obstacles	Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Success-risks obstacles	Wicker (2001)	obstacles and Challenges in Implementing New Technologies in the Poultry Industry	Canada
	Lack of finance	Aubert, Jean-Eric (2004)	Promoting Innovation in developing countries: A conceptual framework. World Bank Institute	World Bank Institute
	Cost and lack of perceived return on investment in e-commerce (financial barriers), technical complexity.	Kapurubandara and Lawson (2006)	Barriers Adopting ICT and E-commerce with SMEs in Developing Countries: An Exploratory Study in Sri Lanka	Sri Lanka
	Lack of finance	Oak (2007)	A review on barriers to implementing health informatics in developing countries	Fiji Islands

Appendix B-: Questionnaire English version

Questionnaire

IT adoption in the Construction Sector in Libya

Mr Mohamed Elkabeer Abdulhadi

The University of Glamorgan

Faculty of Advanced Technology

1 LIantwit Road, Pontypridd, Wales, UK

CF37 1DL

Telephone: +44 7799886665

E-mail: mabdulha@glam.ac.uk

Good day.

My name is Mr. Mohamed Elkabeer Abdulhadi, and I am a researcher in the School of Technology, University of Glamorgan, United Kingdom, carrying out a PhD research focusing on the adoption of IT by firms working in the Construction Sector in Libya.

Thank you for agreeing to answer this questionnaire. I confirm that this survey is for research purposes ONLY and any information you divulge is anonymous and will be treated in the strictest confidence, and will be disposed off after the completion of this work.

If you are interested in the results of this research, an executive report will be sent to you.

Thank you

Part I: Company Characteristics

- Company name: .....
- Number of employees: .....
- In which city your company HQ is located: .....
- What type of business does your company do: .....
- How long have your company been in business:
- Is your company:

  Libyan Public sector ☐ Libyan Private sector ☐ Foreign ☐
- Do you have an IT department: Yes ☐ No ☐
- Do you have a specific budget for IT: Yes ☐ No ☐

Part two: Manager Characteristics:

- Your title in the company: .....
- Your Nationality: .....
- Age: .....
- Gender: .....
- Degree: .....
- Area of qualifications: .....
- Country of graduation: .....
- Do you speak any foreign languages: Yes ☐ No ☐

Note: Please answer the following questions by ticking the right box. By IT, we mean any technological equipment or software which can be used such as computers, internet, programmes, etc.

Part Three: IT Adoption Factors

Questions		Strongly agree	agree	Slightly agree	Slightly disagree	disagree	Strongly disagree
A: Relative advantage							
A-1	Using IT improves the quality of the work we do						
A-2	Using IT improves our job performance						
A-3	Using IT increases our effectiveness						
A-4	Using IT gives us greater control over our work						
A-5	Using IT increases our productivity						
A-6	Overall, we find using IT advantageous in our job						
B: Compatibility							
B-1	Using IT is compatible with all aspects of our wok						
B-2	Using IT is compatible with our current situation						
B-3	We think that using IT fits well with the way we like to work						
B-4	Using IT fits into our works style						
C: Image							
C-1	Using IT improves our image within the company						
C-2	People in our company who use IT have more prestige than those who do not						
C-3	People in our company who use IT have a high profile						
C-4	Having IT is status symbol in our company						
D: Ease of use							
D-1	We believe that IT is cumbersome to use						
D-2	Using IT requires a lot of effort						
D-3	Using IT is often frustrating						
D-4	We believe that it is easier to get IT to do what we want to do						
D-5	Learning to operate IT is easy for us						
D-6	Overall, we believe that IT is easy to use						
E: Result Demonstrability							
E-1	We would have no difficulty telling others about results of using IT						
E-2	We believe we could communicate to others the consequences of using IT						
E-3	The results of using an IT are apparent to us						
E-4	We would have difficulty explaining why using IT may not be beneficial						
F: Visibility							
F-1	We have seen what others do using their IT						
F-2	In our company, one sees IT in many places						
F-3	IT is not very visible in our company						
F-4	It is easy for us to observe others using IT in our company						

Questions		Strongly agree	agree	Slightly agree	Slightly disagree	disagree	Strongly disagree
G: Trialability							
G-1	We usually have good opportunity to try various IT applications						
G-2	We know where we can go to satisfactorily try out various uses of IT						
G-3	Before deciding whether to use any IT applications, we are able to properly try them out						
G-4	We are permitted to use IT on a trial basis long enough to see what it could do						
H: Voluntariness							
H-1	Our clients expect us to use IT						
H-2	Our use of IT is voluntary (as opposed to required by our stakeholders or job description)						
H-3	The government does not require us to use IT						
H-4	Although it might be helpful, using IT is certainly not compulsory in our job						
I: External orientation							
I-1	Our business objectives are driven primarily by clients satisfaction						
I-2	We constantly monitor our level of commitment and orientation to serving our clients' needs						
I-3	Our strategy for competitive advantage is based on our understanding of clients' needs						
I-4	Our business strategies are driven by our beliefs about how we can create greater value for clients						
I-5	We measure clients' satisfaction systematically and frequently						
I-6	We give close attention to after-service contact with our clients						
I-7	All of our managers understand how everyone in our company can contribute to creating client value						
J: Achievement orientation							
J-1	Achievement of goals has a very important place here						
J-2	Being the leader in our field is very important here						
K: Company slack							
K-1	There is generally no scarcity of financial resources for capital projects						
K-2	There is usually abundant availability of required labour skills within our company						
K-3	There is usually no shortage of managerial talent to effectively run our company						
L: Pro-activity							
L-1	Typically, our company responds to actions that competitors initiate						
L-2	Our company is very seldom the first business to introduce new products or technologies						
L-3	Typically, Our company seeks to avoid competitive clashes,						

	preferring a "live-and-let-live" posture						
M: Environmental dynamism							
M-1	Our company must change its marketing practices extremely frequently						
M-2	The rate at which the products/services are becoming obsolete in the industry is very slow						
M-3	Actions of competitors are quite easy to predict						
M-4	Demand and consumers tastes are fairly easy to forecast						
M-5	The production/service technology is not subject to very much change and is well established						
N: Facilitating Conditions							
N-1	We have the resource necessary to use IT						
N-2	We have knowledge necessary to use IT						
N-3	The company staff, in the main office, are available for assistance with IT difficulties.						
N-4	We have knowledge sources (e.g. books, documents, consultants) help us learn about IT system.						
O: Business-Level Attitude Toward IT Adoption							
O-1	The CEO strongly recognizes that IT enhances the company profitability						
O-2	The CEO has high awareness of IT						
O-3	Senior management strongly recognizes that that IT can enhance company competitiveness						
O-4	Senior management has good awareness of IT						
P: Subjective Norm							
P-1	The majority of leading companies within the supply chain use IT						
P-2	The majority of trading parties within the supply chain use IT						
P-3	The majority of peer competitors use IT						
P-4	The government actively promotes IT						
P-5	IT adoption is supported by government grants						
P-6	Our employees encourage us to use the IT						

Q: Type of IT applications used in your company

		Do you use the following?		Rate of use		
		Y-1	N-0	Used with little skills-1	Used with moderate skills-2	Used with extreme skills-3
R-1	LAN					
R-2	AUTOCAD					
R-3	ETAB					
R-4	STADD					
R-5	ORIENT					
R-6	STUDS					
R-7	STRUDS					
R-8	ERP					
R-9	CRM					
R-10	EAI					
R-11	RPM					
R-12	QC					
R-13	TQM					
R-14	JIT					
	Others (Please name)					
R-15	**----------**					
R16	**----------**					
R-17	**----------**					
R-18	**----------**					
R-19	**----------**					

LAN: *Local Authority Network*
ERP: *Enterprise Resource Planning*
CRM: *Customer Relationship Management*
EAI: *Enterprise Application Integration*
RPM: *Rapid Prototyping and Manufacturing*
CBT C*omputer-Based Training*
QC**:** *Quality control*
TQM*: Total quality Management*
JIT: *Just in Time*
Others- *Professional (Engineering)*

General remarks

Please write down any ideas or further comments.

_____

_____

_____

_____

_____

_____

Thank you for your cooperation.

Appendix C-: Questionnaire Arabic version

بسم الله الرحمن الرحيم

Questionnaire

أستبيان

IT adoption in the Construction Sector in Libya
تبني التكنولوجيا في قطاع الأنشاءات في الجماهيرية الليبية

جامعة جلامورجان
University of Glamorgan
Faculty of Advanced Technology

السلام عليكم و رحمة الله و بركاته
أنا الطالب محمد عبدالرحيم الكبير عبد الهادي؛ طالب دكتوراه في قسم التكنولوجيا المتقدمة في جامعة جلامورجان؛ المملكة المتحدة. دراستي تتركز على موضوع تبني التكنولوجيا الحديثة من قبل الشركات العاملة في قطّاع الأنشاءات في الجماهيرية الليبية.
أشكركم على قبولكم للأجابة على هذا الأستبيان. و اؤكد لكم أن هذا الأستبيان لغرض البحث العلمي فقط؛ و أن المعلومات الواردة سَتعامل بأعلى درجات السرية؛ و سوف تتلف بعد إكمال البحث.
إذا كانت لديكم رغبة في نتائج هذا البحث؛ خلاصة البحث سوف ترسل لكم
شكراً لكم

Mr Mohamed Elkabeer Abdulhadi

The University of Glamorgan

Faculty of Advanced Technology

1 LIantwit Road, Pontypridd, Wales, UK

CF37 1DL

Telephone: +44 7799886665

E-mail: mabdulha@glam.ac.uk

الجزء الاول: معلومات عن الشركة (المؤسسة)		
اسم الشركة (المؤسسة):		
عدد العاملين في الشركة:		
أين يقع المقر العام للشركه:		
ما هو نوع العمل الذي تقوم به شركتك؟		
ماهي الفترة الزمنية للشركة في هذا العمل؟		
هل ان شركتك (مؤسستك)	**نعم**	**لا**
هل يوجد قسم لدعم التكنولوجيا في شركتك؟	**نعم**	**لا**
هل توجد لديك ميزانية مخصصة لدعم التكنولوجيا الحديثة؟	**نعم**	**لا**
الجزء الثاني : معلومات عن المدير		
عنوانك الوظيفي في الشركة:		
الجنسية:		
العمر:		
الجنس:		
التحصيل الدراسي:		
الأختصاص:		
بلد التخرج:		
هل تتكلم لغات أجنبية؟	**نعم**	**لا**

ملاحظة:الرجاء الأجابة على الاسئلة التالية بتأشير المربع المناسب و لجوابك. و نقصد بأجهزة التكنولوجيا الحديثة أي جهاز تكنولوجي أو برنامج يساعدنا في اداء عملنا – مثلا أجهزة كومبيوتر؛ أنترنت أو أجهزه هند سيه---------- الخ

الجزء الثالث: العوامل المؤثرة على عملية تبني التكنولوجيا الحديثة

	الأسئلة	موافق تماما	موافق	موافق قليلا	معارض قليلا	معارض	معارض تماما
أ	**الفائدة النسبية –اي الفائدة التي تقدمها الأجهزة الحديثة**						
أ-1	إستعمال أجهزة التكنولوجيا يحسّن نوعية العمل الذي نقوم به						
أ-2	إستعمال أجهزة التكنولوجيا يطور (يحسن) أداء عملنا						
أ-2	إستعمال أجهزة التكنولوجيا يطور فعالية العمل						
أ-4	إستعمال أجهزة التكنولوجيا يعطينا سيطرة كبيرة على عملنا						
أ-5	إستعمال أجهزة التكنولوجيا يزيد من أنتاجيتنا						
أ-6	بشكل عام ؛ نجد إن إستعمال أجهزة التكنولوجيا فيها فائدة لعملنا						
ب	**الملاءَمة (التوافق)- أي ملاءَمة الأجهزة الحديثة مع عملنا**						
ب-1	إستعمال أجهزة التكنولوجيا يتلاءم مع كل مناحي الأعمال التي نقوم بها						
ب-2	إستعمال أجهزة التكنولوجيا يتلاءم مع واقع عملنا الحالي						
ب-3	نعتقد أن إستعمال أجهزة التكنولوجيا يتلاءم تماما مع الطريقة التي نحب أن نعمل بها						
ب-4	إستعمال أجهزة التكنولوجيا يتلاءم مع اسلوب عملنا						
ت	**صورة المستعمل للتكنولوجيا**						
ت-1	إن إستعمال أجهزة التكنولوجيا يحسن صورتنا في داخل الشركة						
ت-2	مستعملي التكنولوجيا في شركتنا يحضون بتقدير أكبر على خلاف غير المستعملين						
ت-3	مستعملي أجهزة التكنولوجيا في شركتنا لهم مكانة مرموقة						
ت-4	تملكنا لأجهزة التكنولوجيا يعتبر رمزا مميزا لمكانة شركتنا						
ث	**سهولة إستعمال التكنولوجيا**						
ث-1	نعتقد أن أجهزة التكنولوجيا صعبة الأستعمال						
ث-2	إستعمال أجهزة التكنولوجيا يحتاج الى جهد كبير						
ث-3	في أغلب الأحيان إستعمال التكنولوجيا يكون محبطا						
ث-4	نعتقد أنه من الأسهل لنا إستعمال التكنولوجيا للقيام بما نود عمله						
ث-5	تعلم إستعمال أجهزة التكنولوجيا شيء بسيط و غير صعب						
ث-6	بشكل عام ؛ نعتقد أن إستعمال أجهزة التكنولوجيا شيء بسيط						

	الأسئلة	موافق تماما	موافق	موافق قليلا	معارض قليلا	معارض	معارض تماما
ج	**تبيان فوائد التكنولوجيا للآخرين**						
ج-1	لا توجد صعوبة في أعلام الآخرين عن النتائج التي نحصل عليها من إستعمال أجهزة التكنولوجيا						
ج-2	بالإمكان سهولة إخبار الآخرين عن العواقب الحميدة لإستعمال التكنولوجيا						
ج-3	إن ثمار إستعمال أجهزة التكنولوجيا واضحة لنا						
ج-4	من الصعوبة القول بان إستعمال أجهزة التكنولوجيا غير مفيد						
ح	**وضوح إستعمالات التكنولوجيا الحديثة**						
ح-1	إننا نرى ما يستطيع الآخرون فعله بفضل التكنولوجيا						
ح-2	يمكن ملاحظة أجهزة لتكنولوجيا في عدة أماكن في شركتنا						
ح-3	إن أجهزة التكنولوجيا غير مرئية و تكاد تكون غير موجودة في شركتنا						
ح-4	من السهولة ملاحظة الآخرين يستعملون أجهزة التكنولوجيا في شركتنا						
خ	**تجريب التكنولوجيا الحديثة**						
خ-1	لدينا فرصة جيدة لتجريب عدة أنواع من تطبيقات التكنولوجيا الحديثة						
خ-2	نعرف أين نذهب لنجرب مختلف أنواع تطبيقات التكنولوجيا بكل راحة و يسر						
خ-3	قبل أن نقرر إستعمال أي تطبيق تكنولوجي ؛ يمكننا أن نجربه قبل الاستعمال						
خ-4	مسموح لنا أن نجرب أي تكنولوجيا و لمدة كافية لمعرفة أدائها و نجاحاتها						
د	**الإستعمال الطوعي**						
د-1	زبائننا يتوقعون أننا نستعمل أجهزة التكنولوجيا						
د-2	إستعمالنا أجهزة التكنولوجيا في شركتنا يتم عن طواعية و ليس جبرا						
د-3	القوانين المعمول بها لا تفرض علينا بإستعمال التكنولوجيا						
د-4	بالرغم من فائدة إستعمال أجهزة التكنولوجيا فإن إستعمالها غير إجباري في أعمالنا						

	الأسئلة	موافق تماما	موافق	موافق قليلا	معارض قليلا	معارض	معارض تماما
ذ	**التوجّه الخارجي**						
ذ-1	المحرك الأساسي لأهداف أعمالنا هو رضا زبائننا						
ذ-2	نراقب باستمرار مستوى التزامنا و توجهنا في خدمة متطلبات زبائننا						
ذ-3	إستراتيجية المنافسة لدينا مبنية على فهم متطلبات زبائننا						
ذ-4	إستراتيجية عملنا مبنية على إيماننا بتقديم عمل متقن للزبون						
ذ-5	نقيس رضا الزبائن بشكل دقيق و بشكل مستمر						
ذ-6	نعطي أهمية كبرى الى ما بعد البيع						
ذ-7	يعرف المدراء في شركتنا كيف يمكن لكل موظف المساعدة في تقديم خدمة ذات قيمة عالية للزبون						
ر	**كيفية تحقيق الأهداف**						
ر-1	تحقيق أهداف الشركة يعتبر من أولويات الشركة						
ر-2	كون شركتنا الرائدة في مجال نشاطنا امر مهم لنا						
ز	**الموارد المتوفرة في الشركة**						
ز-1	بشكل عام لا توجد أي شحة في الموارد المالية للمشاريع الكبرى						
ز-2	لدينا عادة وفرة كبيرة للعمال الماهرين						
ز-3	لا يوجد نقص في عدد المدراء الأكفاء و المتميزين في شركتنا لتيسير الأمور						
س	**روح المبادرة**						
س-1	شركتنا عادة ما ترد بسرعة على أي مبادرة يقوم بها منافسينا في العمل						
س-2	شركتنا نادراً ما تكون أول شركة تقوم بتقديم تكنولوجيا جديدة أو أنتاج جديد						
س-3	شركتنا عادة تتجنب المعارك التنافسية مع الآخرين وَ تُفضل مقولة " كُل و وكّل"						
ش	**حركية المحيط الخارجي**						
ش-1	شركتنا مضطرة لتغيير نشاطاتها التسويقية بشكلٍ سريع و دائم لمواكبة التغييرات						
ش-2	نسبة المواد المنتجة و الخدمات المقدمة التي يزول الطلب عليها في شركتنا ذات نسبة قليلة						
ش-3	من السهل علينا التنبؤ بخطوات و مشاريع منافسينا						
ش-4	حاجة السوق و أحتياجات الزبائن من الأمور السهل توقعها						
ش-5	إن المنتجات و الخدمات التكنولوجية لا تتغير بشكل كبير						

	الأسئلة	موافق تماما	موافق	موافق قليلا	معارض قليلا	معارض	معارض تماما
ص	**العوامل المساعدة لتعلم الأجهزة الحديثة**						
ص-1	لدينا كل الموارد لإستعمال أجهزة التكنولوجيا الحديثة						
ص-2	لدينا المعرفة المطلوبة لإستعمال أجهزة التكنولوجيا						
ص-3	العاملون في في المقر العام لشركتنا مستعدون لمساعدتنا في حالة وجود صعوبات في كيفية إستعمال أجهزة التكنولوجيا الحديثة						
ص-4	لدينا كل الموارد المعرفية (كتب؛ ملفات؛ مستشارين--- الخ) التي تساعدنا لتعلم إستعمال التكنولوجيا						
ض	**رغبة الأدارة العليا لتبني التكنولوجيا الحديثة**						
ض-1	المدير التنفيذي في شركتنا يدرك تماما أن إستعمال الأجهزة التكنولوجية الحديثة تساعد على تعزيز ربحية للشركة						
ض-2	المدير التنفيذي للشركة على وعي كامل بأهمية إستعمال أجهزة التكنولوجيا في اعمال الشركة						
ض-3	الأدارة العليا في الشركة تدرك إن إقتناء الأجهزة الحديثة يحسن القدرة التنافسية للشركة						
ض-4	الأدارة العليا في شركتنا على دراية جيدة بالأجهزة التكنولوجية الحديثة						
ط	**تأثير الآخرين علينا**						
ط-1	معظم الشركات الكبيرة التي ترتبط معنا في العمل تستعمل الأجهزة التكنولوجية						
ط-2	معظم الشركاء التجاريين الذين لنا علاقة تجارية معهم يستعملون الأجهزة التكنولوجية الحديثة						
ط-3	معظم المنافسين لنا في العمل يستعملون الأجهزة التكنولوجية الحديثة						
ط-4	الدولة تدعم بقوة إستعمال الأجهزة التكنولوجية						
ط-5	تبني الأجهزة التكنولوجية عادة ما يدعم بمنح من قبل الدولة						
ط-6	الموظفون في شركتنا يشجعوننا على إستعمال الأجهزة التكنولوجية						

ظ : نوع التطبيقات (برامج الكومبيوتر) المستعملة في شركتك

	هل استعملت التطبيقات التالية ؟			درجة الاستعمال		
	نوع التطبيق	نعم -1	لا -0	تستعمل و لكن قدراتنا في إستعمالها ضعيفة-1	تستعمل و لكن قدراتنا في إستعمالها متوسطة-2	تستعمل و بتمكن تام-3
ع-1	LAN					
ع-2	AUTOCAD					
ع-3	ETAB					
ع-4	STADD					
ع-5	ORIENT					
ع-6	STUDS					
ع-7	STRUDS					
ع-8	ERP					
ع-9	CRM					
ع-10	EAI					
ع-11	RPM					
ع-12	**QC**					
ع-13	**TQM**					
ع-14	**JIT**					
	تطبيقات اخرى(الرجاء ذكرها)					
ع-15	----------					
ع-16	----------					
ع-17	----------					
ع-18	----------					
ع-19						

LAN: *Local Authority Network*
ERP: *Enterprise Resource Planning*
CRM: *Customer Relationship Management*
EAI: *Enterprise Application Integration*
RPM: *Rapid Prototyping and Manufacturing*
CBT C*omputer-Based Training*
QC**:** *Quality control*
TQM*: Total quality Management*
JIT: *Just in Time*
Others- *Professional (Engineering)*

تعليقات عامة

الرجاء أذا كانت لديك أفكار أو تعليقات يرجى تدوينها في الفراغ التالي

_____

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شكراً على تعاونكم **محمد عبدالرحيم الكبير عبد الهادي**

Thank you for your cooperation.

Appendix: D- Qualitative Methodology results

Interviews were carried out with 26 managers who work in Libyan construction industry. The sample comprises of 19 public organisations, 5 private organisations and 2 foreign organisations located in different part of the country. Six questions were used in the interviews as follows:

Q1: You know that there is a huge and rapid development in the field of Information and Communications Technologies (ICT), could you please tell me, what is your organisation doing i.e its activities? And what type of hardware/software and areas of applications are currently in use in your organisation?.

Q2: Do you rely mainly on the ICT systems which are available in your organisation?. This means that do you get the most benefits from the ICT systems installed in your organisation in your daily lives activities?

Q3: Please let me know what are the internal barriers (i.e those within the control of the SMEs) which face the adoptions and implementations of the ICT systems in Libyan SMEs?

Q4: Please let me know what are the external barriers (i.e. those not within the control of the SMEs-e.g. government policy) which face the adoptions and implementations of the ICT systems in Libyan SMEs?.

Q5: Could you please tell me what are your new requirements from the ICT systems (i.e new hardware/software) to improve the performance of current practices in your organisation?

Q6: Do you have suggestions on how to move forward to improve the current practices of the ICT in Libyan SMEs?.

The findings are shown below

Interview-1:

Company name: Water Investment Company

Interviewee name: Consulting Engineer Sultan

Location: Serit (Main office: Tripoli)

Type of business: Engineering

Background of the interviewee: Engineering sciences

Type of company: public - North

Q1: You know that there is a huge and rapid development in the field of Information and Communications Technologies (ICT), could you please tell me, what is your organisation doing i.e its activities? And what type of hardware/software and areas of applications are currently in use in your organisation?.

Answer to Q1:

Our main activities are civil engineering projects related to the construction of water networks, sewers networks, gas pipes, electricity and communication towers and roads between cities.

We currently use the technologies in our activities. We use engineering equipment such as theodolites, levels, and special equipment connected via satellite to provide the office by aerial maps to the projects. This will help the engineers/surveyors on the ground to plan and fix the coordinates of the projects.

From the ICT viewpoint, we use the following hardware: computers/printers, fax, mobiles, and landlines. We also use the following software: MS Windows, MS office Excel, MS Word, Adobe Acrobat (PDF), AutoCAD.

Q2: Do you rely mainly on the ICT systems which are available in your organisation?. This means that do you get the most benefits from the ICT systems installed in your organisation in your daily lives activities?

Yes we rely on using the technology in our daily activities. We use computers to serve our activities such as design of the projects, preparing the drawings, calculations, and for communications purposes.

The mobile is mainly used to contact the contractors and other companies in our management chain.

Q3: Please let me know what are the internal barriers (i.e those within the control of the SMEs) which face the adoptions and implementations of the ICT systems in Libyan SMEs?

In general the main office is supporting the use of the advanced technology in our activities. For example the office installed last month high speed internet connection to improve the communication between the main and branches offices.
There is a shortage in the skilled workforce.
I feel that the language could be a barrier for the employees on using the software packages available in our offices.
The security of the internet and the PCs are vital problems need to be sorted out.
Lack of Libyan national engineers who have experience in engineering software related to the engineering sciences such analysis and design and modelling.

Q4: Please let me know what are the external barriers (i.e. those not within the control of the SMEs-e.g. government policy) which face the adoptions and implementations of the ICT systems in Libyan SMEs?.

In general the state is supporting the utilisation of the ICT in all the offices around the country. However, low awareness and education of the public on using the new technology needs to be tackled.
We have poor network communication between the main headquarter and our branches around the country. This is a problem especially in the desert areas where the network coverage is very poor.
We have also problems of poor post office services. This affects our activities and communications with our business partners.

Q5: Could you please tell me what are your new requirements from the ICT systems (i.e new hardware/software) to improve the performance of current practices in your organisation?

Our main demand is that we ask all our colleagues and employees to use this technology to develop themselves. Training is a vital factor in this issue.

Q6: Do you have suggestions on how to move forward to improve the current practices of the ICT in Libyan SMEs?.

We have the following suggestions:
--Improve and develop training system (internally and externally)
-contribution in conferences and seminars
-improve education of human resources.
-improve banking system.
-more financial support to the ICT
-ICT systems is important for us and needs to be continuously improved
motivations (financial and non-financial rewards) to encourage staff to use the ICT systems.
-Transport for the employees
Myself and other colleagues have been sent to America for training purpose on the project management and this improve my understanding to project management issues.

Interview-2:
Company name: Consulting Engineering bureau) -Challenge university
Interviewee name: Consulting Engineer-Husham Hassan
Location: Tripoli-Libya)
Type of business: Engineering design
Background of the interviewee: Engineering sciences
Type of company: public-WEST

Answer-Q1:
Our work is related to the engineering projects around the country. This bureau is considered one of the largest bureau in libya. This head office has branches in many Libyan cities such as Benghazi, Sert, Masrat, Sabha, Alzaweyah, midland, and other places located in the east, west, and south of the country. Our main duties are design activities.

We have different types of hardware such as: computers/printers, faxes, landlines and mobiles. We use software such as: MS office and other specialists engineering

software such as AutoCAD and other software used in the design of roads and sewers networks.

Answer-Q2

Yes we get most benefits from the equipment installed in our bureau. We use these equipment on daily basses in our activities in the design office and other office activities.

Answer-Q3:

In general there are some internal obstacles in the bureau, for example we have some obstacles related to the communication with companies (especially private companies), which do not use the ICT in their daily lives business. This makes it difficult for us to do communication via the new technologies approach. Other obstacle related to the availability of the ICT skilled workforce.
We have also language barrier (since most software and websites are written in English language). This affects the performance of our employees'.

Answer-Q4:

There are no serious external obstacles to us in using the ICT in our activities. The state supports the new technology and the excommunication sector. For example the calls to mobile from any landline are free. However, there are some problems related to the communication network coverage of the desert areas. The post services are also poor and affect our daily activities.

Answer-Q5:

I believe that the main requirements can be summarized below:

Develop the educational system in schools and universities
Promote the availability of the computers in the primary/intermediate/secondary schools and institutes
Develop student abilities in English language since most programs are in English language
Training courses for the engineers/consultants

Answer-Q6:

Increase training courses-internally and externally

Encouraging the exchanges between Libyan and developed foreign countries in the field of ICT such as Britain, America, Italy, Germany, etc.

Encouraging student to study aboard to be familiar with the latest development in the field of new technologies.

Interview-3:

Company name: Roads and Bridges Company

Interviewee name: Director of the company

Location: Tripoli-Libya)

Type of business: Engineering construction

Background of the interviewee: Engineering sciences

Type of company: Private-foreign company (Turkey)-FOREIGN -WEST

Answer-Q1

The main activities of this company are designing and construction roads and bridges around the country. The company uses the advanced technology in the design and construction processes of engineering projects. We use the technology in surveying calculations, soil mechanics analysis and concrete calculations.

We have advanced hardware technologies such as computers/printers, USB, faxes, mobiles, landlines, Internet, and communication via satellite unit for communication with our partners out side Libya. We sent the documents of many project to our partners outside the country to design/check the design via Internet and other means such as DVD, USB. Most of our documents are saved on computers storage facilities instead of using paper files. This saves time, money and efforts.

As far as the software is concerned we have MS office, engineering programs.

Answer-Q2

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our system.

- -Using the internet for sending/receiving documents
- -Using CD/DVD for/posting and saving data

- -Using FAX in sending documents
- -Using mobile/landline to follow to communicate with contractors/other partners

Answer-Q3

The main internal barriers could be summarised below.

Skilled human resources- we need to develop the people abilities in computer sciences.

Develop the abilities of engineers to be able to deal with foreign companies.

Language communication problem with Libyan organisations

Answer-Q4:

The external obstacles are related to poor banking system, and low awareness and education of the public on using the new technology. Internet security is also an important factor in this regard.

There are other problems related to the high imposed taxes on foreign companies.

There is also an important problem related to high money related to renting of land to build foreign companies in near the construction sites.

There is another problem related to the delay in the schedule of payment for the completed works.

Visa problem for the foreign workers.

Answer-Q5:

I believe the main requirement is to continue in updating the ICT systems.

Answer-Q6:

I have the following suggestions:

- -Improving education of human resources.
- -improving banking system.
- -We should introduce the latest technology in our organisations
- encouraging the travel to foreign countries to see the development in the ICT sector.
- Improving the training system

- Encourage the universities to create in training courses

Interview-4:

Company name: Consulting Bureau

Interviewee name: Consulting Engineer - Abdul Salam AlAzrany

Location: Bengazi

Type of business: DESIGN

Background of the interviewee: Engineering

Location of company: public- EAST

Answer-Q1:

Our office activities are related to carrying out studies and supervising large public projects related to the state around the country.

We use most of the advanced technologies (hardware) such as computers/printers, mobiles, landlines, and faxes.

We use MS office, and programs related to engineering and surveying purposes.

Answer-Q2:

We use the computers and the Internet in most of our activities. The following benefits gained from the use of the advanced technologies:

- using the internet in sending/receiving documents and for communication
- -using the computers for designing/drafting engineering projects.

Answer-Q3:

The most important internal obstacles are as follows:

- Shortage in national skilled workforce in the ICT field. As a result of this problem we depend on the external expertises from the Arab world and from other foreign countries. We usually use these specialised bureau and companies to solve technical problems and train our national individuals.
- Lack of training courses
- Lack of availability of foreign skilled workforce in the ICT field.

- Security of the internet
- Lack of Libyan national engineers who have experience in engineering software related to the engineering sciences such analysis and design and modelling.

Answer-Q4:

The external barriers are as follows:

Government Laws and regulations

Lack of ICT skilled foreign workforce

Answer-Q5:

Suggestions

There are no requirements since most of ICT systems are available and supported by the state.

Answe-Q6:

Suggestions:

- Establishing department of R & D in the office
- Delegating authorities from top to bottom management in decision taking related to the IT.
- To high light the importance of the ICT systems, I suggest that courses (internally and externally) to be carried out for all the employees (top management and the subordinates)
- We need to concentrate on the management and develop it to be IT management to serve our activities and our partners and customers. The success in the management is a vital factor in promoting the ICT system in any organisation. The top management should take a role in spreading the IT in the organisations.
- Quality of the top management is a vital factor in supporting the use of the ITC systems in any organisation.
- Create motivation and rewards schemes to encourage people to use the ICT systems.
- Create competitive environment in the organisations to encourage people to use the ICT systems.
- All the required ICT recourses should be available to create IT environment.

- Engineers and consultants should keep in touch with the latest version of technology. This can be done be encouraging them to read research/papers/articles published in journals/magazines related to the ICT systems.
- Give more power to managers in branches (this is in case of main office has many branches around the country). The independency of the branches from their main office is a good idea (i.e this means more power related to the ICT decisions should be given the junior managers in the branches). This could serve the spreading of the ICT systems in the organisation and encourage users to get most benefits from them.
- We need to input new expertises in our organisation.
- Top managers should be competent in ICT systems and should have the ideology to encourage people to use the IT in our organisations.
- More time should be spent on the Internet to search for the new development in the ICT field.
- We must develop our abilities in the ICT field to compete with the foreign companies working in Libya.

Interview-5:

Company name: Control utility company

Interviewee name: Consulting Engineer - Qadri

Location: Tripoli

Type of business: Contractors

Background of the interviewee: Engineering

Type of company: Private company –libyan-WEST

Answer-Q1

Our main activities are related to execution of projects for the state. We have relationship with Al-Qarzawyah Company in Sabha. We also carryout maintenance for state projects.

We installed in our office different types of hardware such as: computers/printers, faxes, mobiles, landlines, data show (minicomputer). We have also engineering

equipment such surveying equipment (theodolites, levels), GPS(wireless communication) and other communication equipment.

We depend on using the following software (MS office, AutoCAD, JAVA, and other engineering programs.

Answer-Q2:

We use the available hardware/software to carry out our activities such as design processes and communication with other companies (national/international). The internet is an important tool in our communication.

Answrer-Q3:

The main internal barriers are summarised below:

- Many managers have conservative approach toward the adoption and spreading the ICT systems (they do not support and encourage the utilisation of the ICT in our daily activities). This point should be treated by appointing the appropriate person (preferably specialised in ICT) to deal with decisions related to the ICT technologies.
- Non-availability of laptop for the site engineers.
- Non-availability of the communication technologies for site engineers. This reduces our efficiency in carrying out our activities.
- Lack motivations and rewards for the employees to encourage them to use the new technology.
- Lack of training courses internal and external in the field of the ICT.
- -Low salaries
- Human resources – skilled workforce.
- Holding conferences in IT
- -the management should has the power to take decisions related to the ICT systems
- High taxes imposed on the private companies
- Delay in payment and also delay in the overtime payments.
- Many private companies prefer the old paperwork

Answer-Q4:

External barriers

Lack of government regulations and laws related to use of the ICT

Problems in accommodation of engineers, which affect our activities

Lack of power delegated to junior managers. This point should be treated and more power should be allocated to junior managers from the central office.

Answer-Q5:

No requirements are needed, however the systems should always be updated.

Problems with extension of foreign workers residency

Answer-Q6:

More communications with other developed countries

This research is very useful for us, since it will highlight the barriers face our organisations and how to improve our current situation.

Interview-6:

Company name: Research, planning, Maintenance Company

Interviewee name: Engineer – Director of the company-Mr Saleh

Location: Benghazi

Type of business: engineering

Background of the interviewee: Engineering

Type of company: public-EAST

Answer-Q1

Our activities are engineering activities. These include construction civil engineering projects, surveying works to layout water, sewer pipes and other structures.

We have engineering equipment to be used in our daily activities such as theodolites and levels.

We have different types of hardware such as computers/printers, faxes, landlines, mobiles, GPS and other communication equipment such the internet and the intranet.

Our software include MS office, AutoCAD, STAAD (structural analysis and design software), and other software used in the design of the water/sewers pipe networks.

Answer-Q2

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT software installed in our system.

- -Design/documentations
- We use the Internet and intranet in our daily activities

Answer-Q3

The main internal barriers are as follows:

Lack of Training and workshops,

-Lack of finical support

-Lack of motivations to the employees

-Lack of contribution in internal/external conferences

Lack of national expertises in using engineering software in construction industry

Security of the information

Language is a problem for some employees in using the internet and visiting websites.

Answer Q4

The main external barriers are summarised below:

- Poor banking system and low awareness and education of the public on using the new technology.
- -the state should support training course and encouraging the use of the IT in all Libyan offices
- Many managers do not support and encourage the employees to use the IT in their activities. The state should punish manager/director who doesn't support the IT promotion
- Poor post office services and this affect our business activities.

Answer-Q5

Health of the economy

Answer-Q6

- Improve education of human resources.
- Improve banking system

Interview-7:

Company name: Directorate of roads and railway lines

Interviewee name: Engin**eer** – Abdulqader-MSc-Canada

Location: Midland

Type of business: engineering

Background of the interviewee: Engineering

Type of company: public-NORTH-Serit

Answer-Q1

We main activities and duties are related to the designing of highways and railways lines to connect the Libyan cities. We also deal with rural roads connect Libyan cities and villages.

We use advanced engineering equipment such as theodolites, levels, GPS and other equipment connected to the satellite. The satellite equipment help us in getting aerial pictures and also help in finding the coordinates and the path of roads and railways which are intended to be designed.

Answer-Q2

We use different types of hardware and software in our activities. As far as the hardware is concerned we use computers/printers/plotters, faxes, landlines, mobiles and Internet. The software includes MS office, AutoCAD ,MS project , Adobe Acrobat (PDF) and other engineering software used in the design of engineering projects.

Answer-Q3

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our system.

- -Internet is widely in use-internally and externally –to communicate with our customers, a partner inside Libya and outside Libya.

- -Aerial surveying
- Engineering works (roads design, etc)-
- documents are saved on computer storages
- we use the mobiles to communicate with the contractors and our employees on site

Answer-Q3

There are some internal barriers such as:

- Shortage and non-availability of the advanced technologies equipment in Libyan market (examples laser printers/plotters)
- Speed of the Internet network is low (and sometimes cutoff completely). This makes very difficult for to send /receive documents via the Internet.
- Poor banking system and low awareness and education of the public on using the new technology
- -IT training inside Libya and abroad should be encouraged
- Shortage of the Libyan national skilled workforce specialized in the ICT field. We must rely on the national individuals rather than on the foreigners in this matter.
- Increase the training in the field of ICT internally and externally
- Lack of our national expertise in the ICT software related to the engineering businesses.

Answer-Q4

The main external barriers are

- In spite that the state supports ICT sector, unfortunately we find that many bosses do not support this field, and this has a direct negative effect on our activities. For examples upgrading the computer hardware and software and also upgrading the Internet speed are major issues for us.
- Poor post office services which have negative impact on our activities
- Poor banking system

Answer-Q5

Our requirements are as follows

Continuous development and upgrading of the existing systems

Answer-Q6

I have the following suggestions

- Developing the skills of our nationals in IT field rather than rely on the foreigners.
- Develop our educational curriculums in the field of ICT. This should start from the primary schools towards the universities and higher institutions.

Interview-8:

Company name: General water company-Great Manmade River

Interviewee name: Engin**eer** – DR Hussain Mohammed Abo Baker

Location: Midland-Serit

Type of business: engineering: Engineering

Background of the interviewee: Engineering

Type of company: public-NORTH-SERIT

Answer-Q1

Our duties are to supply bring water from the desert region and supplying the Libyan cities, towns, villages with fresh drinking water. Part of this great project also provides agricultural farms with water. Our office comprises of five administrative such finance office, maintenance, technical office, employees' office and the tenders' office.

We work in cooperation with national companies such as (AlQarzawyah Company) and with international companies such German, Korean companies in the engineering field.

We have many different types of hardware such as computers/printers, faxes, mobiles, landlines and internet.

We installed software such as MS office, AutoCAD, SAP(engineering program used in the analysis of engineering structures), Masterflow (program used in the design of the hydraulic structures).

Answer-Q2

Yes we rely on our installed systems in our daily activities as design, communication, storage information in digital forms etc. we use also the mobile and landlines to communicate with our engineers and employees on the site.

Answer-Q3

The main internal barriers are summarized below:

Computer viruses

Computer Fraud especially when we use the Internet

Difficult to have original copies of the software (since the programs are ready installed on our system). This makes it difficult to deal with any problems related to the program corruption.

Internet security

Shortages in national expertise specializing in engineering software

Lack of motivation to the employees

Answer-Q4:

Low awareness and education of the public on using the new technology.

The state usually promotes the use of the IT and the Internet, however, some managers do not support and promote the use of the IT in construction industry

-Training is vital for our development

-following up the development in the IT field.

Poor post office services

Answer-Q5:

More training to improve the skills of our workforce

Internet security

Answer-Q6:

The universities and other training bodies should promote ICT training

Cooperation with foreign companies to promote training courses

Send people abroad for training purposes

We need to spend more time on reading research/articles related to the development in the ICT field.

Interview-9:

Company name: Enrkra Company –Italian company for construction of roads and bridges

Interviewee name: Engin**eer** –Proni- Italian national

Location: Sebha

Type of business: Engineering

Background of the interviewee: Engineering

Type of company: Private-foreign –Italy- SOUTH

Answer-Q1

Our company specialised in construction roads, bridges and buildings and we have many branches in different cities of Libya. We also build hospitals, schools towers, hotels and other large infrastructures in the state of Libya. We have contracts with state to design and execute many civil engineering projects.

We have all the facilities of the advanced technologies. From the hardware point of view we have computers,/printers (normal and laser printers), photocopiers, faxes, mobiles, landlines. There are many engineering equipment related to concrete tests, soils mechanics tests, surveying equipment (e.g theodolites, levels etc), internet, intranet, GPS and other equipment connected to the satellite to facilitate the communication and helps in carrying out our engineering works.

Answer-Q2:

We rely mainly on the use of the installed hardware/software in our daily activities. We carry out our works by using the equipment installed in our office. The communications using conducted by using our intranet and via the Internet and other communication tools such as landlines and mobiles. Our main office is located in Italy. We use also the fax to send reports and design drawings.

Answer-Q3

We have no internal barriers in using the installed technologies.

Answer-Q4

We have no external barriers, however, we have problems related to the extension of our residency in Libya (visas), but now the Libyan authorities have given attention to solve this problem. We have other problems related to high taxes and high cost related to renting lands for foreign to build their premises on near to the site.

Answer- Q5:

I do not think we need anything since we have all the required facilities to run a modern office.

Answer-Q6

We have the following suggestions

- Introduction of new technologies (hardware/software) to Libya organizations
- -Training to the employees
- -Conferences
- -Research and development
- -Motivations and rewards to the employees
- Increasing the Training courses for the engineers

Interview-10:

Company name: Directorate of operating and maintenance of great manmade **river**

Interviewee name: Engineer Fathy Alquzary

Location: Bengazi

Type of business: engineering: Engineering

Background of the interviewee: Engineering

Type of company: public-EAST

Answer-Q1

Our duties are related to operating and maintenance of the pumping stations and pipelines of the great manmade river infrastructure.

We have different types of hardware such as computers/printers, faxes, mobiles, and landlines.

We have software such as AutoCAD, MS project, MS Excel, MS Word, Adobe Acrobat (PDF). We also have special software to control the flow through the pipelines. These pipelines are connected to control room to control the flow passing through their cross-sections, which monitored by our engineers and technicians.

Answer –Q2

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our system.

- -office use of computers
- Internet communication
- -Internet sending/receiving documents
- We also use the fiber optic network for communication (new communication network)

Answer-Q3

The main internal barriers are:

Sometimes cut-off the network and this affects our activities

There is no coverage to mobile network in the desert areas. This affects the mobile communication and makes it difficult to contact our employees. Now the general communication company started to tackle this problem.

Employees should look take care when using the equipment

- create an official training body in computer sciences
- Training courses in Libya and abroad
-financial support

Answer-Q4

Poor banking system and low awareness and education of the public on using the new technology

Poor post office services

Answer-Q5

No requirements

Answer- Q6

In order to develop the utilization of the ICT systems in Libyan organizations, I have the following suggestions:

Create a training body to run training courses

Sending engineers/IT personal aboard for training purposes and be familiar with latest version of IT technologies

Motivation is very important factor in encouraging people to use the new technologies. Financial and non- financial rewards are very important in this sense.

Contribution in conferences/seminars

Interview-11:

Company name: Registry office of land and records keeping

Interviewee name: Engineer Mussa Miftah

Location: Serit

Type of business: engineering: records keepings

Background of the interviewee: Engineering

Type of company: public-NORTH

Answer-Q1

Our main activities are related to register the ownerships and maintain records of lands, houses, and other facilities for both the state and the citizens. Our main aim is to register the ownership and details of the proprieties and also to prevent fraud in falsifying documents related to the ownership of the public and citizens properties.

We use different types of hardware such Computers/printers/ fax/ landlines and mobiles, intranet and Internet. We also use engineering surveying equipment such as levels, theodolites and GPS connected to the satellite.

We installed in our office different types of software such as MS office, AutoCAD, Adobe Acrobat (PDF) and other types of software.

Answrer-Q2

Yes we rely mainly on the ICT systems, and we get the most benefits

from the ICT systems installed in our system.

- Our system connected with other offices such as banks, hosing associations, and other Libyan authorities

-Advanced technologies are used to prevent fraud in records. We use the intranet/internet to check information quickly and this will help in preventing fraud and deceptions.

-Using the Internet

Answer-Q3

The main barriers are summarized below.

Lack of national skilled workforce to manage our records properly. In order to improve our business activities we made contract with Jordanian company specialized in management. This will help us how to cope and get most benefits from our installed advanced technologies.

-Lack of motivations to the employees to use the ICT systems

Lack of experiences in using the engineering software

Answer-Q4

We do not have external barriers since the state support us by installing the ICT systems to help us running our businesses.

Poor banking system

Poor post office services

Answer-Q5

Our main requirements can be summarised below

We need to upgrade our systems continuously. This will help us to improve our performance and also to develop our employees' abilities on how to deal with the new versions of technologies.

We must use modern scientific and practical management in our organisations. The old style of management is not valid in these days.

We should have enough financial support to improve our ICT performance.
We should create competitive environment between employees and rewards schemes should be put in practice to encourage employees to use the new technologies.

Employees Motivations is vital issue to encourage them to use the technologies.

Training of the employees is very important factor to develop their abilities. I suggest internally and externally training courses should be organised for this purposes.

Contribution to conferences and seminars/internally and externally to update our themselves with the latest ideas and methodologies.

I suggest that the head of the offices in Libya should have higher degrees such as MSc, PhD etc. The highly qualified person is a more enthusiast in supporting the adoption of the new technologies.

Answer-Q6
Improve the public awareness of the importance of the ICT in our daily lives.

Interview-12:
Company name: Directorate of the distribution, purchases, and services of **electricity**
Interviewee name: Engineer- Salem Ahmed Hussain (Director)
Location: Serit
Type of business: engineering: Engineering
Background of the interviewee: Engineering
Type of company: public-NORTH

Answer-Q1
Our activities are related to generation and distribution of the electricity to the Libyan cities, towns and villages.
We use different types of Hardware such as Computers/printers, Faxes, landlines, mobile, intranet and Internet (and special network called IBS, and fibre optic equipment).

As far as the software we use and the following applications: MS Excel, MS Word, Adobe Acrobat (PDF), AutoCAD, and other engineering programs. We have also engineering equipment such as theodolites, GPS, and to be used locate the electricity towers and their connection with the national network.

Answer-Q2

Yes we use the installed hardware/software in our daily activities. We send reports, information, and also we control the supply of the electricity by the computer.

Answer-Q3

We have the following internal barriers

Shortage in the skilled workforce. For example sometimes if the computer breakdowns it takes between two to three days to repair the computer. This affects our daily activities.

Lack of national expertises in the field of engineering software

Answer-Q4

The external barriers are as follows:

There is no cooperation between the bosses to solve problems face the employees. This point should be tackled to help us in improving our daily activities.

Poor post office services

Security of information

Answer-Q5

We need continuous upgrade to the hardware/software installed in our office. This will help us in developing our knowledge in using the new technologies.

Answer-Q6

- Training plan should be in place on the national scale to tackle the ICT illiteracy
- Motivations schemes and rewards should be put in place in Libyan offices to encourage employees to use the new technologies.

- At the present time we have cooperation with foreign companies from France, Canada, and Korea, in the field of management development. This approach should be supported and more contracts should be signed with foreign companies to improve our understanding of the usefulness of the new technologies and also to understand the areas of their utilisations.

Interview-13:

Company name: Directorate of housing

Interviewee name: Engineer- Faraj Abdul Hafeez

Location: Benghazi

Type of business: Engineering

Background of the interviewee: engineer

Type of company: public-EAST

Answer-Q1:

Our activities are related to design and execution of infrastructure projects related to housing projects.

We use different types of hardware such as: computers (desktop and laptop), faxes, internet, mobiles, landlines, printers and photocopying machines. We use AutoCAD software for the design purposes, and we have also other software such as MS office and others. We use engineering equipment such as theodolites, levels, GPS (connected to the satellite to help us to find the coordinates of the projects. We have also aerial photocopying equipment connected to the satellite to get aerial photos of our projects.

Answer-Q2

Yes we rely on the use of these installed hardware/software in our daily activities. We use the Internet to send/receive documents and communication with our partners.

Answer-Q3:

The most important internal barriers can be summarised below:

- There is no continuity in training courses in our office to develop the skills and abilities of our employees in ICT field inside and outside Libya.

- There is no plan to put the suitable person in the right position. This is related to the fact that the main office sometimes imposes people who are not efficient and do not support ICT adoption. However, there are attempts to improve the situation.
- Limited authorities given to the junior managers. More power should be give to the middle managers to take decision related to the ICT systems in their offices.

Answer-Q4:

External barriers: The state is supporting the utilisation of the new technologies in our offices. Usually a lot of money spends by the state to support the ICT sector.

- Poor banking system
- Poor post office services

Lack of network communication coverage to the desert areas.

Answer-Q5:

Our requirements: We need the latest versions of technologies in our offices. For example we need the latest equipment in surveying to improve the performance of our field activities.

Answer-Q6-suggestions

- Appoint the suitable person in the right position
- Continuous Training courses for each office according to its field of working.
- More laws and regulations to clarify how to use the systems
- Motivations to employees and encouragement on the use of the ICT systems. This can be achieved by financial and non-financial rewards to the employees to encourage them to use the new technology.
- Attending ICT conferences
- More communication with national and international companies related to the ICT issues. From our experiences we found that the foreign companies are more organised and advanced in using the ICT systems in their activities compared with our national companies.

Interview-14:

Company name: general company of seaports

Interviewee name: Consulting Engineer- Amjad Mahmood

Location: Tripoli

Type of business: Engineering

Background of the interviewee: engineer

Type of company: public-WEST

Answer-Q1

Our works are related to the development and supervision of all works related to the Libyan seaports. We insure that the quality of the works done by companies compatible with internal specifications.

We have different types of hardware in our company such computers, Internet, faxes, mobiles, landlines, printers, and other electronic equipment usually used in seaports. We use also surveying equipment and other equipment to measure the rise/fall of seawater heights in our seaports. This equipment is connected by wireless means to give signal to the computer to record the required information.

Answer-Q2

We use the internet in our daily communication and also we use the landlines and mobiles for this purpose. We also have intranet, which is usually be used to by our employees to send/receive documents and for communication purposes with our companies inside and outside Libya.

Answer-Q3

Internal barriers: the most important internal barriers are:

The communication network does not cover wide areas of Libya and this affects our communication with our partners and has a negative impact on our performance.

Qnswer-Q4

The external barriers: we do not have external barriers since the state support the IT field.

Answer-Q5

The requirements:

The equipment should not be misused.

We need the latest version of technology (hardware/software) to improve our activities.

Answer-Q6

Suggestions

- The state should create strategy and training body responsible for training people to be specialised in the field of ICT. Our company should also create its own training programs to improve the skills of our employees.
- Training courses inside/outside Libya for the engineers to improve their IT skills.
- Attending conferences and seminars related to the IT (outside/inside Libya)
- Motivations should be encouraged to the employees –financial and non-financial rewards. This will create competitive environment and improve the outputs of our activities.

Interview-15:

Company name: Directorate of Al-Fateh University

Interviewee name: Engineer- Jebreel Ali

Location: Tripoli

Type of business: Engineering

Background of the interviewee: Engineering

Type of company: public-WEST

Answer-Q1

Our duties are related to the design and construction of projects related to the Al-Fateh University. In addition directorate carried out other activities such maintenance to the university equipment, electrical and air-conditioning, supporting the computer centre in the university, and other activities to support the university staff and students in their teaching and learning programs.

Answer-Q2

And we currently use different types of hardware such as computers/printers, faxes, internet, mobiles and landlines. Also we use many applications in our daily activities such as: AutoCAD ,MS project ,MS Excel , MS Word , Adobe Acrobat (PDF). We have also advanced surveying equipment and GPS unit connected via satellite to help us in our surveying activities.

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our office. We use the Internet, mobiles and landlines to communicate with other university offices and with our partners outside the university. Using the installed equipment save us time, money and efforts.

Answer-Q3

Internal barriers

We do not have internal barriers

Answer- Q4

We do not have external barriers since the state support the adoption of the ICT systems.

Answer-Q5

Our requirements

Continuous maintenance to the existing equipment

Support the use of the latest versions of hardware/software to be competitive with other advanced countries.

Answer-Q6

Suggestions

Develop our selves in using this advanced technology in technical, administrative and financial issues.

Motivations- financial and non-financial rewards to the employees to encourage them to use the technology

Attention should be given to the training (internal/externally) on how to use, repair this technology.

Contribution in conferences/seminars to related to the issue of ICT

Appoint the suitable person in the right position

Interview-16:

Company name: Directorate of planning –housing sector

Interviewee name: Engineer- Najeah Abdulsalaam-

Location: Sabha

Type of business: Engineering

Background of the interviewee: engineering

Type of company: public-SOUTH

Answer-Q1

Our activities are related to the planning, design, monitoring and execution of civil engineering projects.

We have different types of advanced technologies in our office such as computers/printers, faxes, landlines, and mobiles.

We have software such MS office, SAP –engineering program, AutoCAD, and others. Also we have surveying equipment and GPS unit connected to the satellite.

Answer-Q2

We use the installed hardware/software in our daily activities. We use the computer in the design, planning, and preparing reports etc. we use the internet in the communication with other engineering consulting offices and in sending/receiving documents.

Answer-Q3

Internal barriers

We have broken-down computer equipment which affect our activities

We also suffer from the computer viruses and this also have a major impact on our activities in sending/receiving documents via the internet.

We have also another problem, which is related to the updating of the software/hardware. We have some old software and need to be updated.

Poor post office services

Lack of technical expertises in engineering software

Anwer-Q4

External barriers

Internet cut-off. This prevents us from getting Internet on daily basis and this delays our activities in communicating with our partners. The state is started to sort this problem.

Lack of communication network coverage to the desert areas

Answer-Q5

requirements

plan should put in place related to Managerial/administrative development on using the advanced technologies businesses.

We need intranet for our main office and its branches.

Answer-Q6

suggestions

We need to concentrate on the training and scientific courses

We need also to hold conferences/seminars to discuss and exchange ideas of the latest news and invention in the field of ICT (internally and externally).

Communicate with the developed countries to get more benefits in this important field.

Motivation and financial and non-financial rewards should be employed to encourage the employees' use of the new technologies.

Interview-17:

Company name: Housing Directorate

Interviewee name: Architect Ibrahim Obaid

Location: MESRATA

Type of business: Engineering

Background of the interviewee: engineering

Type of company: public-NORTH

Answer-Q1

We job is to build houses for Libyan citizens and this is one of the infrastructure in Libya. We also contract with foreign companies to design and construct house and other infrastructure projects in Libya.

We use different types of hardware such as computers/printers, faxes, landlines, mobiles, and photocopying machines. We have also engineering equipment use in surveying. We have also GPS connected via satellite, which helps in surveying activities.

We have different types of software such MS office, Photoshop, AutoCAD and other engineering programs

Answer-Q2

We use the technology in our daily activities. For example we use the internet for communications, and for sending/receiving documents to and from the local and foreign consulting engineers' bureaus. We have also intranet which is being used by our employees and by our partners. We have good relationship with American bureau, which helps us in the training and providing us with new version of technology.

Answer-Q3

No internal barriers

We run training courses for our employees and also for the engineers.

Answer-Q4

External barriers

- No external barriers since the state supports the technology use in our office.
- Security of the internet

Answer –Q5

- Our requirements is to connect all our branches by one private connection network (intranet). This makes it easy for our employees to access the network.

Answer-Q6:

Suggestions

To develop the performance of the Libyan employees in general, I suggest the following:

- Develop training programs to raise the skills of the employees. In our office we have a training centre to train our employees on the use of the ICT systems.
- Motivations-financial and non-financial rewards for the employees
- More Financial support to the IT sector
- Attending conferences and seminars in Libya and outside Libya.

Interview-18:

Company name: roads and bridges company

Interviewee name: Moeen Alsalaly

Location: Jefrah

Type of business: Engineering

Background of the interviewee: engineering

Type of company: public-SOUTH

Answer-Q1

The main activities of the company are design and constructing roads and bridges around the country. The main office is in Tripoli and it has three branches located in the east, west and middle of the country. Each branch is responsible for carrying out its activities with the support of the main office. We also have contracts with the national and foreign companies to carryout works in this area.

We use different types of hardware such as computers/printers, faxes, mobiles, landlines, Internet, telex, and photocopying machines. We have also engineering equipment such as theodolites, levels, GPS, and other equipment connected to the satellite to provide us with aerial photos and coordinates of the projects. We have also MS office and other engineering software which are used in the design and monitoring the progress in our projects.

Answer-Q2

We use the available equipment in our daily activities. We use the intranet in sending receiving documents and also to communicate with our partners in business. We also use the Internet to communicate with national and foreign companies related to business matters.

Abswer-Q3

Internal barriers

- Shortages and non-availability ICT equipment and updated software required in our daily activities
- Cut-off of the Internet, which affect our communication and activities

Answer-Q4

External barriers

- There is no enough coverage communication to desert areas and this affects our business activities.
- Shortage advanced technologies to be used on sites.
- Non-use of the advanced technologies appropriately to serve the purposes for which they have been designed

Answer-Q5

Requirements

We usually need the latest version of technologies (hardware/software). This means we should cope with rapid change in the world.

Answr-Q6

Suggestions

- To develop the performance of the Libyan employees we should continuously follow up the development in the ICT sector in the world around us
- Increase training inside and outside Libya.
- Continuous review to the universities and educational institutions curriculum's in the field of the ICT to update our selves on how to cope with the rapid development in this important field.

- Attending conferences and seminars
- Motivational schemes should be followed to encourage our national to use the new technologies

Interview-19:

Company name: AlWaha contracting company

Interviewee name: Engineer Ali Issa

Location: Alzawyah –50 km west Tripoli established 1980

Type of business: Engineering

Background of the interviewee: engineering

Type of company: private /Libyan -WEST

Answer –Q1

Our activities are related to building housing projects to accommodate Libyan citizens. We usually design and construct these projects to high specifications. The company got many letters of thanks from many official bodies for its high quality of products.

We have equipment related to hardware such as computers/printers, faxes, mobiles, landlines, photocopying machines. We have also engineering equipment such as theodolites, levels, GPS and others such as wireless communication equipment Connected to the satellite.

We have programs such as AutoCAD ,MS project ,MS Excel , MS Word , Adobe Acrobat (PDF). We have also engineering programs related to the concrete structures analysis and design, soil mechanics and foundation design software, and surveying programs.

Answer-Q2

We use the installed technology such as the Internet in our communication and sending/receiving documents from other business partners. We also use the faxes for this purpose. The mobiles and landlines are also used in our daily activities to serve our business purposes. The computer and the available software are used in the analysis and design of engineering projects.

Answer-Q3

Internal barriers

Delays in financial payments for the executed projects

High taxes impose on private companies

Answer-Q4

External barriers

- Non-availability of skilled workforce in the field of engineering (e.g. building and construction workers)
- Problems with residency of the foreign workers

Answer-Q5

Requirements

We need continuous updating of the installed hardware/software. We have computer engineers from Iraq, India, Dubai, Egypt and this is very useful factor for us to develop our installed systems.

Answer-Q6

Suggestions

- We need to concentrate on training and development programs for our national in the field of the ICT. This should be encouraged inside and outside Libya.
- Motivation and rewards schemes (financial and non financial rewards) to encourage people to use the new technologies

Interview-20:

Company name: DAAM company-

Interviewee name: Engineer Mohammed Hilo- Director of the technical affairs

Location: ALZAWEYAH

Type of business: Engineering

Background of the interviewee: engineering

Type of company: public-WEST

Answr-Q1

Our company carry out civil, hydraulic, mechanical and electrical engineering activities.

We have different types of advanced technologies of hardware such as computer/printers, faxes, landlines, mobiles, and Internet.

We have software such AutoCAD ,MS project ,MS Excel , MS Word , Adobe Acrobat (PDF) and other engineering software used in the analysis and design of engineering projects.

Answer-Q2

We use the Internet to communicate with our business partners in USA, Britain, gulf state, Germany, Italy, Malta, and Egypt. Also we use the Internet to send/receive documents from our business partners. We also use the landlines, mobiles, faxes, and the Internet to communicate and sending/receiving information with our business partners in Libya,

Answer-Q3

Internal barriers

Most equipment are available, however, there is low attention to the upgrading the hardware and updating the software.

Lack of skilled people specialised in the field of engineering software

Answer Q4:

External barriers

Poor banking system and low awareness of the usefulness of the ICT systems are barriers.

Low educational level of the public and misunderstanding the benefits of the ICT systems

Poor post office services

Answer-Q5

We the latest version of technologies of both hardware/software

Availability of national technical expertises in the field on ICT

Answer-Q6

suggestions

Changing the management attitudes toward use of the ICT systems. More development are needed in this matter

Motivations and rewards to the employees to encourage them to use the new technologies.

Holding conferences/seminars inside and outside Libya in the field of ICT systems

Interview-21:

Company name: Public relation and development training company-housing company

Interviewee name: Engineer Hussain Al-Zarooq

Location: Midland- Serit

Type of business: Engineering

Background of the interviewee: engineering

Type of company: public-NORTH

Answer-Q1

We supervise the tenders of the Great River. We have technical, financial, legal and managerial committees to deal with this. Our duties can be summarised below:

- Checking and approving the projects design
- Review all the projects documents and then give our approval
- Supervise the quality of works in the executed projects

We have computers/printers, faxes, landlines, and mobiles. We have software such as MS office and other engineering software.

Answer-Q2

Most we use world and excel in our business activities. We also use engineering drawing programs to do the drawings.

Answer-Q3

Internal barriers

- The most important barrier is that most managers are (traditional managers or old fashion managers) and they do not depend on the new technologies. This is a serious problem in spite that many of them have high educational degrees.

Answer-Q4

In general there are no external barriers, however, the rate of the introduction of the new technologies is relatively slow and I believe this will be sorted out in the future. There is another issue which is related to the non-availability of the national skilled workforce in the Libyan market.

Answer-Q5

- Requirements
- Increase the Internet security.
- We ask for advanced internet communication network to connect all the main office with the branches
- Also we need advanced hardware/software to facilitate the connection between head office and its branches to improve the performance of our activities

Answer-Q6

Suggestions

I wish to have e-government for both public and private sectors to serve the society as a whole

Interview-22:

Company name: Center of research and studies and technological development

Interviewee name: Dr Ihsan Ali

Location: Midland-Serit

Type of business: Civil engineering

Background of the interviewee: Engineering

Type of company: public-North

Answer-Q1

Our main activities are carrying out research.

We currently use (hardware/software) in our center for our applications

the following:
MS Excel, MS Word, Adobe Acrobat (PDF).

Answer-Q2

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our system

Answer-Q3

The main internal barriers are
Only human resources – skilled workforce

Answer-Q4

The main external barriers are

- Poor banking system
- Low awareness and education of the public on using the new technology

Answer-Q5

requirements

- Internet security

Answer-Q6

suggestions

- Improve education of human resources
- Improve banking system

Interview-23:

Company name: Electricity Maintenance Company
Interviewee name: Dr Mohamed Ali
Location: SEBHA
Type of business: maintenance of electrical installations
Background of the interviewee: electrical engineering
Type of company: public-SOUTH
Answer-Q1

Our main activities are related to the maintenance of the electricity equipment, power stations, and power transition lines.

We use different types of hardware/software in our company. We use computers/printers, faxes, landlines, and mobiles. We use many software applications such as AutoCAD ,MS project ,MS Excel , MS Word , Adobe Acrobat (PDF).

Answer-Q2

Yes we rely on the installed ICT systems in our daily activities.

Answer-Q3

Internal barriers

Non availability of the skilled workforce

Internet security of information

Answer-Q4

The external barriers

- Poor banking system
- Low awareness of people of the usefulness of the ICT systems
- Poor post office services

Answer-Q5

Requirements

Heath of the economy

Answer-Q6

Suggestions

Improving the banking system

Improving the educational level of the human resources

Interview-24:

Company name: Home consulting office

Interviewee name: Dr salem

Location: BEGAZI

Type of business: Design

Background of the interviewee: engineering

Type of company: private-EAST

Answer-Q1

Our activities are related to the financial services. We use different types of software such as computers/printers, faxes, landlines and mobiles. We use software such as MS office, Adobe Acrobat (PDF) and other software related to the financial activities.

Answr-Q2

Yes, we depend mainly on the use of the installed hardware/software in our business activities. This saves us time, money and efforts.

Answer-Q3

Internal barriers

Lack of training

Lack of workshops

Answer-Q4

External activities

Low awareness of the usefulness of the ICT systems

Low educational level of public on how to use the new technology

Answer-Q5

Requirements

Security of the information on the installed computers

Security of sending/receiving information via Internet

High taxes on private companies

Answer-Q6

Suggestions

Improving the educational level of the human resources.

Interview-25:

Company name: BEATT consulting office

Interviewee name: muftha faraj

Location: TAJORAH

Type of Business: Design

Background of the interviewee: engineering

Type of company: PRIVATE-WEST

Answrer-Q1

Our company offers financial services to companies and individuals.

We have hardware systems installed in our office such as computers/printers, landlines, faxes, photocopying machines and mobiles. We have also software applications such as MS office, Adobe Acrobat (PDF) and other financial software.

Answer-Q2

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our system. This helps in saving money, time and efforts.

Answer-Q3

Internal barriers

Shortages in the skilled workforce

Answer-Q4

External barriers

Poor banking system

Low educational level of the public on using the new technology

Answer-Q5

Requirements

Internet security

Availability of skilled workforce

Answer-Q6

Suggestions

Improving the educational level of the workforce in the field of ICT systems

Improving the banking system

Interview-26:

Company name: Engineering office

Interviewee name: fatma mohamed

Location: SERIT

Type of business: design and construction

Background of the interviewee: engineering

Type of company: private -NORTH

Answer-Q1

Our activities are engineering training on engineering drawing. We have hardware systems such as computers/printers, faxes, landlines and mobiles. We have also software applications such as AutoCAD, MS project, MS Excel, MS Word, Adobe Acrobat (PDF).

Answer-Q2

Yes we rely mainly on the ICT systems, and we get the most benefits from the ICT systems installed in our office.

Answr-Q3

Internal barriers

Shortage of skilled workforce in the field of ICT systems

Answer-Q4

External barriers

Poor banking system

Low awareness and education of the public on using the new technology.

Answer-Q5

requirements

internet security

Answer-Q6

Suggestions

Improving the banking system

Improve the educational system in the field of the ICT.